TTY FORUM - 18

Meeting Summary Report

June 12, 2001
ATIS Conference Center
Washington, DC

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TTY/TDD FORUM – 18

June 12, 2001
ATIS Conference Center
1200 G Street, NW, Suite 500
Washington, DC

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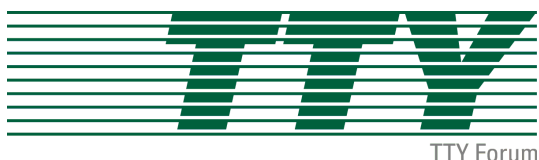
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TTY/TDD Forum – 18

June 12, 2001
ATIS Conference Center
1200 G Street, NW, Suite 500
Washington, DC

Meeting Summary

1. Call to Order, Introductions and Attendance Roster

Ed Hall, chair of the TTY Forum, called the meeting to order, introductions were made and the attendance roster was circulated.

2. Call for and Numbering of Contributions

All contributions provided to the Secretariat electronically are available for download at http://www.atis.org/tty/ttyforum.htm. Contributions were submitted and numbered as follows:

Number	Title
TTY18/01.06.12.01	Agenda
TTY18/01.06.12.02	Roster
TTY18/01.06.12.03	TTY17 Meeting Summary
TTY18/01.06.12.04	TTY17 Agreements and Action Items
TTY18/01.06.12.05	Lucent Report to TTY Forum – 18
TTY18/01.06.12.06	TTSI Report to TTY Forum – 18
TTY18/01.06.12.07	TTY Error Rate Testing Tools
TTY18/01.06.12.08	Krown FastType
TTY18/01.06.12.09	GTT Standardization
TTY18/01.06.12.10	TTY Status and Solution Enhancement
TTY18/01.06.12.11	VoiceStream TTY Report for June 2001
TTY18/01.06.12.12	TTY Standard
TTY18/01.06.12.13	Testing against user requirements
TTY18/01.06.12.14	Ericsson Report to TTY Forum – 18
TTY18/01.06.12.15	Notes on Evaluating Solutions against the User Requirements List
TTY18/01.06.12.16	TTY User Intervention (i.e., mode switch)
TTY18/01.06.12.17	Motorola Report to TTY Forum – 18
TTY18/01.06.12.18	Features and Functions
TTY18/01.06.12.19	Tools for Field Testing TTYs with Wireless Phones
TTY18/01.06.12.20	TTY18 Agreements and Action Items

3. Review & Approve Agenda

The agenda was distributed and approved without modification.

4. TTY Forum #17 Summary

Ed Hall asked if there were any suggested modifications to the TTY Forum #17 Meeting Summary. There were none and the document was accepted as final.

5. Correspondence

- Judy Harkins, Gallaudet, introduced Contribution TTY18/01.06.12.07 and TTY18/01.06.12.13 which introduce the topic of testing against user requirements. She explained that Gallaudet University is currently set up to aid in testing.
- Ed Hall, ATIS, introduced Contribution TTY18/01.06.12.08, which is an email from Krown TTY Manufacturers. The email explains that there is no difference between FastType and TurboCode.
- Ed Hall, ATIS, introduced Contribution TTY18/01.06.12.12, which is an email from David Baquis of the Access Board. The email noted that V.18 does not include FastType or TurboCode because they are proprietary codes.

6. TTY Liaison Reports: FCC; CTIA; NAD; TDI

- FCC: Mindy Littel introduced all FCC attendants and their titles and departments at the Commission. She thanked all entities that filed their reports last quarter and noted that the reports will continue to be required through the deadline of June 2002. She noted that the reports are helpful to the FCC for the purpose of knowing what is being done and what challenges lie ahead for the industry. Ed Hall thanked Mindy and asked if there was anything that could be done to make the reports more effective. Mindy noted that she thought that the reports were on target.
- CTIA: no report
- NAD: no report
- TDI: Jim House noted that TDI is currently planning their conference and that the deadline for registration is next week.
- ATIS: Ed Hall noted that ATIS is co-sponsoring with TIA the FCC Part 68, ACTA terminal certification program. He also noted that Beth Wilson from SHHH was both a member of the ACTA and a TTY participant. In addition, Ed noted that June 13-14 is the inaugural meeting of the AVSS/IVR Forum, which is a continuation of the AVSS forum held by Gallaudet University last year and will address the topic of making IVR Systems more acceptable to users with disabilities.

7. Review TTY Forum #17 Agreements and Action Items

Ed Hall reviewed all agreements and action items from the TTY Forum #17. There were no comments submitted on those items.

8. Industry Implementation Status Reports

Ed Hall noted that verbal reports could be made at this meeting, but should be followed by a written submission to the TTY Forum Secretariat by July 11, 2001. Megan Hayes, ATIS, noted that more information regarding status reports was available on the TTY Forum web site at http://www.atis.org/atis/tty/ttyforum.htm.

LUCENT TECHNOLOGIES

Jim Huntley and Steve Benno from Lucent Technologies introduced Contribution TTY18-01-06-12-05, which is an overview of Lucent's Implementation Status Report for the second quarter of 2001.

VOICESTREAM WIRELESS
Mark Cosgrove, VoiceStream Wireless, introduced Contributions TTY18-01-06-12-11, which is VoiceStream's Implementation Status Report for the second quarter of 2001.

CINGULAR WIRELESS
Sean Campbell, Cingular, noted that there has been a huge improvement in the communications between manufacturers and operators since the last TTY Forum. He further noted that the improved communication has put Cingular in a better position to meet the FCC deadlines.

However, Cingular still has some concerns on the availability of hardware and software both on the infrastructure and the handset sides. Mr. Campbell wanted to stress that the manufacturers and the operators need to continue to work together in order to be able to meet the FCC deadlines.

Mr. Campbell noted that TDMA centric testing of the no gain solution for the TDMA markets should commence shortly. They plan to have an implementation schedule developed in the third or fourth quarter of 2001. Cingular is ready to test GSM infrastructure in their markets. During the last GSM-NA conference in Calgary, there was an agreement on a final architecture solution to allow operators to choose which architecture best fits the operators' needs. At this time, the solution does not delay the roll out but allows for further interoperability and roaming for consumers. In addition, no pre-subscription is required. Cingular will begin work with the PSAPs as soon as the infrastructure testing is complete.

AT&T Wireless
Scott Prather, AWS, noted that the focus of their report is on test activities and mentioned that test documentation has been developed. Recently, they submitted a proposed preliminary field test plan to the GSM-NA for GSM handsets. A similar document exists for the TDMA handsets and they would like to make the document generally available to the forum as appropriate. The test plan is evolving as they continue with ongoing lab testing.

They are using modems supplied by Ultratec, the Intelimodem 2400, modified for use with a wireless device. That test bed is set up in their lab and they are using the Lober & Walsh set up. Their lab testing has been in a static environment. When they ran through the normal scenario of tests, evaluating both up-link and down-link on TDMA on a Panasonic and Nokia handset, they found character error rates which were consistently at 0%, with rare error rates seen at under .10%. There are some interactions with commonly used network functions that need to be addressed. For example, call waiting will interrupt the audio path briefly for the beep tone. If the caller hangs up to answer the call, 2-3 characters are lost during the interrupt and 3-5 characters are lost during the hanging up.

A typical character loss for a Short Message Service (SMS) message 70 characters long is a 7-10 TTY character loss. If the alert tone from the phone is brief, there will be a loss of 8-10 characters, but if the alert tone is longer, there will be more characters lost. If someone accidentally hits a key on the handset keypad, there will also be character loss. They were not able to do any inter-system handoff testing.

Usually, there is no character loss when the call is first set up, but occasionally, there is a one character loss or repetition. In the non-TTY mode, they found a considerable problem with a character error rate as high as 18%. Mr. Prather noted that there is quite a bit of impact on the lasting effects of echo characters depending on the quality of cable that connects the TTY to the handset. The quality of those cables needs to be addressed if there is to be reliable communication over TTY.

It was noted that this problem is not due to echo from the handset but is caused by intermediary cables that the consumer may use between the handset and the TY device. The users questioned how the consumer would make the selection of cable to ensure the least echo and the clearest message delivery. It was noted that this topic would be put aside to be further discussed during the technical activities portion of this meeting.

David Nelson, NAD, Norman Williams, Gallaudet, and Beth Wilson, SHHH, stated that they felt a sufficient solution to the loss of characters during a call waiting interrupt would be the ability to turn off the call waiting feature.

ERICSSON
Matt Kaltenbach presented Contribution TTY18/01.06.12.14, showing the status of testing and development at Ericsson. He noted that within handset development CDMA and TDMA work is now almost complete. Testing has begun on a number of products currently in development, and agreements are being reached on 711 and 911 PSAP testing. In testing that has already concluded, they have found that there are very low error rates for CDMA and that the Vocoder passes data bi-directionality. They found the GSM error rates below 1% under non-fading signal conditions, and that specific signal levels need further study.

On the network side, the latest ballot version of the CDMA standard is being used for testing in the transcoder solution. The test case executions will begin around the end of July and the software development tests should be completed by August 15th. The development schedule for TDMA is on track and ballots are being monitored to incorporate any changes of standards. With GSM they have moved to the circuit pooling solution to follow the industry consensus per 3GPP TS 23.226.

Sean Campbell, Cingular, thanked Ericsson for the level of detail in their report and invited other manufacturers to provide similar detail in their reports.

David Nelson, NAD, asked the FCC if the 311 non-emergency call center has to be accessible to TTY users, and Pam Gregory from the FCC noted that they haven't designated 311 nationwide to date and that her understanding is that the Commission is still considering it. Ms. Gregory also noted that the FCC needs to further investigate the requirements of the ADA before deciding on this issue. Toni Dunne, NENA, noted that there are areas of the nation that are implementing 311 for non-emergency calls and that in those areas, the same staff or level of training is found for 311 call takers as with the 911 call takers. David Nelson noted that the TTY Forum should keep in mind that 311 might become a future requirement for TTY accessibility.

MOTOROLA

Paul Hall, Motorola, introduced all the Motorola representatives present. He then presented Contribution TTY18/01.06.12.17, which is a schedule of testing for CDMA, GSM, and TDMA. He noted that IDEN and CDMA are currently ready for First Office Application (FOA).

Norman Williams, Gallaudet, asked for the details on the user-test plan. Paul responded that the handset would be given to a test group of users to provide feedback of their experience. He noted that Motorola would be interested in having Gallaudet involved in the testing.

NEXTEL

Bob Montgomery, Nextel, noted that they, too, are on track for user and infrastructure testing.

NORTEL

Charles Spann, Nortel, reported that they will have product availability before the FCC deadline. They do see some challenges including handset availability because testing is revealing small problems with user interface. They are looking to handset manufacturers to get handsets for testing as soon as possible. Mr. Spann noted that one of the most pressing issues in testing is the lack of precise information from TTY manufacturers. This lack of information is making it difficult to determine whether unidentifiable problems in the carrier and handset testing are coming from the TTY machines or whether there is an issue that needs to be addressed on the part of the carrier or handset manufacturer.

9. Technical Activities

GTT Standardization:

Gunner Hellstrom, Ericsson, presented Contribution TTY18/01.06.12.09 regarding GTT Standardization.

A participant asked Mr. Hellstrom to define SIM-less phone, and he noted that SIM stands for Subscriber Identity Module and is a card that goes in a GSM phone to designate the user. A participant asked how a SIM-less phone could be used in an emergency. Chuck Wood, US Cellular, noted that only a 911 call could be made from a SIM-less phone. Mr. Wood then asked how CTM service would be accessed. Mr. Hellstrom responded that the phone would be able to access the CTM from the call set-up within the phone. Patrick Forster, FCC, asked if the phone would need to be set up or if the phone would automatically detect a TTY device. Mr. Hellstrom responded that there are several options at this point for how a phone would recognize TTY capabilities.

GSM Standards Update

Mark Cosgrove, VoiceStream, mentioned that a lot of the standards work for GSM has been distributed for approval as release 5 in the 3GPP. A lot of the work currently being done is on the architectural side. The changes have moved forward to the final GSM-NA approval at

the end of June. The new solution using a circuit-pooled solution has moved on for approval from the GSM-NA.

User Intervention (Action Item #17.2)

Judy Harkins, Gallaudet University, noted that at the last TTY meeting, GU was tasked with researching the feasibility of having user intervention in order to make digital wireless systems work in concert with TTY machines. She introduced Contribution TTY18/01.06.12.13, which is entitled "Testing Against User Requirements." She explained that this document annotates the requirements with notes about evaluation issues and field test procedures from a user perspective. Several participants thanked Ms. Harkins for the document and suggested that it should become a permanent part of the TTY Forum Record.

AGREEMENT REACHED (18.1): Contribution TTY18/01.06.12.13, "Testing Against User Requirements" will be added to Appendix D: TTY Test Completion Matrix of the TTY Forum Meeting Summary.

ACTION ITEM (18.2): The Secretariat will add contribution TTY18/01.06.12.13, "Testing Against User Requirements" to Appendix D: TTY Test Completion Matrix of the TTY Forum Meeting Summary.

ACTION ITEM (18.3): Judy Harkins will provide the URL for the web site describing the testing tools technology to the TTY Secretariat to make the information more readily available to TTY Forum participants.

Ms. Harkins also noted that in her conversations with TTY Users, there were a number of common questions asked about the set-up of such user intervention features.

Questions regarding user intervention for TTY users:
1. How often does this have to be done?
2. How many steps are there?
3. How complicated are the steps?
4. Is it easily discovered without using the user's manual?
5. Is it clearly documented?
6. Is there a visual status indication?
    - During set-up?
    - Ongoing?
7. Does it interfere with other features?
8. Will it be possible to make a voice call while in TTY mode?
9. Will VCO be a choice or will it be supported as a TTY mode? (Will VCO be incorporated into this mode or is there a series of choices in TTY mode?)
10. How long does it take? How fast can you set it up?
11. Is it possible to change modes during a call?
12. Is it standardized across handsets?
13. Is it usable in an "eyes busy" environment?
14. Is the process of hooking up the equipment and putting it into TTY mode too long or arduous to be able to answer it in time?

15. When receiving an incoming call, does the phone ring, or does it vibrate?

AGREEMENT REACHED (18.4): The list of questions regarding user intervention (Contribution TTY18/01.16.12.15), will be considered for further discussion of user intervention.

TTY Technical Standards Issues (TTSI) Incubator

Ed Hall, ATIS, presented Contribution TTY18/01.06.12.06, which is a report on the TTSI Incubator. Mr. Hall noted that during April 2001, a special TTY technical focus group was formed under the ATIS Incubator Program, the TTY Technical Standards Implementation (TTSI). The incubator was set up to address specific problems faced by wireless handset manufacturers, some network equipment and TTY manufacturers. It is an opportunity to address problems with standards to people involved, and then bring the results back to the standards organizations.

Mary Brooner, Motorola, asked if there was precedent for this type of a model for the impact to the standards industry. Mr. Hall replied that there was no precedent at this time, but the hope in this case is to meet the FCC deadline. Ms. Brooner was also concerned with what changes could be made in the incubators, and how set in stone these results would be. David Nelson, NAD, asked if the final standards would be obvious to the consumers, to help assure them that they are purchasing an appropriate product. Beth Wilson, SHHH, replied that changes in standards are common and would continue to occur after the FCC deadline, but the priority is to ensure that the standards accurately reflect all the issues, problems and questions that are discovered. David Nelson further inquired if it would be necessary to do a lot of research on the consumers' part to be sure that the models being purchased would be the appropriate ones. Norman Williams, Gallaudet University, noted that all televisions that are capable of closed captioning are labeled per FCC regulations. Ed Hall responded that from his experience, when a phone has been developed and brought to the point of sale it will, in fact, be labeled "TTY Compatible". Susan Palmer, Cingular, emphasized that it may not be that simple and the discussion requires further thought and input from the consumers. Ed Hall suggested continuing the discussion under the New Business agenda item.

AGREEMENT REACHED (18.5): The product labeling issue will be deferred until the next TTY meeting due to time constraints.

Other

- *Echo Control:* Matt Kaltenbach noted that Ericsson engineers have been discussing echo control since November but it has taken until several weeks ago to evaluate how it effects TTY. He presented TTY18/01.06.12.19, which is a diagram depicting the Echo Suppressor issue.
- *Call Features and Functions*
  Ed Hall introduced this topic by stating that several of the industry participants have asked for input from the consumers on which features and functions are most useful, and which, if any, can be disabled for TTY users. He noted that the discussion would proceed on a feature-by-feature basis.

Ed Hall asked if call-waiting is a feature that can be disabled for TTY Users. Sean Campbell, Cingular, stated that call waiting can be disabled, but it is a more permanent solution. It was also noted that some available handsets do have the ability to turn off call waiting on a per call basis.

There was discussion regarding the level of interruption that call waiting produces in a TTY call, as compared to the interruption of call waiting into a voice call. The users also expressed concern about how a TTY user would identify call waiting without the ability to hear the tone. They stressed that it is harder to answer an incoming call when you are already typing a conversation as a TTY user needs to wait until the person on the other end of the call concludes typing before they can answer an incoming call. The users emphasized that call waiting is not a feature often used in conjunction with TTY. Beth Wilson proposed that call waiting is an underused and interruptive feature, and proposed that it is not a significant loss to have call waiting disabled for TTY users. There was a comment by Dick Brandt that some cell phone packages do not even include call waiting. The final concern of the users was what happens when one call comes in on another call. Linda Day asked if disabling call waiting also disables "missed call" Dick Brandt answered that in his experience the "missed call" feature is not deactivated, and people are usually forwarded to voice mail.

The following are agreements reached (they will be recorded as 18.6) regarding features and functions for digital wireless service for TTY users:

CALL WAITING (CW)
- CW interferes with TTY communications.
- CW as a feature is disruptive and often not used by TTY users. Disabling CW by default for phones in TTY mode is an acceptable solution to the consumer community.
- CW can be disabled in a GSM environment (either permanently or via the handset menu).
- CW cannot be disabled via the handset menu in a TDMA environment; it has to be disabled at the switch.

VOICEMAIL/TTY MAIL (VM)
- Some systems do not record and play back to TTY machines as well as others.
- VM should be placed on the next TTY Forum agenda and referred to the AVSS/IVR Forum.

SHORT MESSAGING SERVICE (SMS)
- SMS signals may cause interruption in TTY communications.
- SMS is a desired feature for the consumer community.
- Queuing of SMS messages during a TTY conversation is not supported in some networks.

10. Next Generation TTY

Ed Hall introduced Elizabeth Lyle, formerly of the FCC, to present on Next Generation TTY. Elizabeth Lyle, Wallman Strategic Consulting, explained that it is important to keep disability accessibility in mind when designing new products.   Jim Tobias, Inclusive Technologies, discussed how the evolution of text products has been discussed in both current and next generation text issues. He noted that it is important to promote the disability accessibility requirements of text-messaging. Jim emphasized that innovations in the future of wireless text can promote the use of such features as call waiting.

Elizabeth Lyle also noted that she had sent a proposal to ATIS for Wallman Strategic Consulting to produce a cover letter for the FCC report, summarizing the information within the report.

ACTION ITEM (18.7): Elizabeth Lyle will submit a written proposal for a consolidated report for submission to the FCC. This report will be posted to the TTY Forum web site.

11. Next Meeting

AGREEMENT REACHED (18.8) The next meeting of the TTY Forum (#19) will be held September 26 at the ATIS Conference Center in Washington, DC.

AGREEMENT REACHED (18.9) TTY Forum #20 will be held December 11 at the ATIS Conference Center in Washington, DC.

12. New Business

There was no new business at this meeting.

13. Adjournment

Ed Hall adjourned the meeting at 4:30pm.

Respectfully submitted by Megan Hayes, TTY Forum Secretariat.

TTY18
June 12, 2001
Washington, DC
Meeting Roster

Name	Company	Phone	Fax	Email
Kitch Barnicle	Trace R&D Center	608-263-5697	608-262-8848	barnicle@trace.wisc.edu
Scott Beith	Kyocera Wireless	858-882-1949	858-882-3677	sbeith@qcpi.com
Steven Benno	Lucent Technologies	973-739-1210	973-386-2651	benno@lucent.com
Brye Bonner	Motorola	847-576-5920	847-538-5564	brye.bonner@motorola.com
Philip Boothby	Kyocera Wireless	303-247-2001	303-247-2151	philb@qcpi.com
Dick Brandt	Gallaudet University	908-310-7941	215-970-3208	dbcon@att.net
Bill Breslin	ATIS	202-662-8667	202-393-5453	wbreslin@atis.org
Mary Brooner	Motorola	202-371-6900	202-842-3578	mary.brooner@motorola.com
Lori Buerger	AT&T Wireless	312-258-2906	312-258-2025	lori.buerger@attws.com
Kevin Butler	Sprint PCS	816-559-4587	816-559-4295	kbutle02@sprintspectrum.com
Sean Campbell	Cingular Wireless	404-236-5322	404-236-5949	sean.campbell@congular.com
Mark Cosgrove	Voicestream Wireless	425-653-4744	425-378-5160	mark.cosgrove@voicestream.com
Steven Coston	Ericsson	919-472-7527		steve.coston@ericsson.com
Linda Day	AT&T Wireless	559-284-4485	559-438-5713	linda.day@attws.com
Toni Dunne	NENA/Positron	512-291-8160	512-291-8176	tdunne@positron911.com
Chris Fernandez	Lucent Technologies	630-224-7873	630-713-2972	chrislf@lucent.com
Leo Fitzsimon	Nokia	202-887-5330	202-887-0432	leo.fitzsimon@nokia.com
Patrick Forster	FCC	202-418-7061	202-418-7247	pforster@fcc.gov
Scott Freiermuth	Sprint	913-762-7736	913-762-0922	sfreie02@sprintspectrum.com
Pam Gregory	FCC	202-418-2498	202-418-1414	gregory@fcc.gov
Ed Hall	ATIS	202-628-6380	202-393-5453	ehall@atis.org
Paul Hall	Motorola	425-487-5921	425-483-3400	paul.hall@motorola.com
Judy Harkins	Gallaudet University	202-651-5677	202-651-5476	judy.harkins@tap.gallaudet.edu
Megan Hayes	ATIS	202-662-8653	202-393-5481	mhayes@atis.org
Gunnar Hellstrom	Ericsson	+46709860315	+46-8-164-80	gunnar.hellstrom@era.ericsson.se
Jim House	TDI	301-589-3006 (TTY)	301-589-3797	jimhouse@tdi-online.com
Jim Huntley	Lucent Technologies	973-386-4331	973-386-2651	jmhuntley@lucent.com
Matt Kaltenbach	Ericsson	919-472-1818	919-472-6105	matt.kaltenbach@ericsson.com
Sarah Leeper	CTIA	202-736-3223	202-785-8203	sleeper@ctia.org
Mindy Littell	FCC	202-418-0789	202-418-7247	mlittel@fcc.gov
Al Lucas	Motorola	561-739-2505	561-739-2504	al.lucas@motorola.com
Elizabeth Lyle	WSC	202-349-4002	202-347-4961	lylee@wallman.com
Bob Montgomery	Nextel	703-433-8315	703-433-8355	bob.montgomery@nextel.com
Majid Nawaz	NEC America	214-262-4463	214-262-4225	mnawaz@necam.com
David Nelson	NAD	202-906-2500 (TTY)		djn@amtrak.com
Susan Palmer	Cingular Wireless	202-419-3009	202-419-3047	susan.k.palmer@cingular.com
Scott Prather	AT&T Wireless	425-702-3960	425-702-3033	scott.prather@attws.com

Julie Rones	USTA	202-326-7254	202-326-7333	jrones@usta.org
Blaise Scinto	FCC	202-418-1380	202-418-7247	bscinto@fcc.gov
Pieter Seidel	Panasonic	770-338-6270	770-338-6253	pseidel@panasonicatlanta.com
Charles Spann	Nortel Networks	903-852-6798	903-852-3827	spann@nortelnetworks.com
Bonita Stafford	PCS One	717-721-7262	717-721-7299	bstafford@pcsone.com
Jerome Stanshine	FCC	202-418-2417	202-445-3220	jstanshi@fcc.gov
Karen Strauss	FCC	202-418-1400	202-418-2839	kstrauss@fcc.gov
Jim Tobias	Inclusive Technologies	732-441-0831		tobias@inclusive.com
Ilan Vardi	Siemens	858-521-3537	858-521-3108	ilan.vardi@icn.siemens.com
Sean White	FCC	202-418-2453	202-418-1414	swhite@fcc.gov
Norman Williams	Gallaudet University	202-651-5257	202-651-5476	norman.williams@tap.gallaudet.edu
Beth Wilson	SHHH	301-657-2248	301-913-9413	bwilson@shhh.org
Chris Wojnar	TDI			cnwojnar@hotmail.com
Chuck Wood	US Cellular	773-399-7090	773-399-4984	cwood@uscellular.com
Watson Zan	Rogers Wireless	416-935-6031	416-935-7502	wzan@rci.rogers.com

The following companies submitted their TTY Implementation Status Reports for the second quarter of 2001 through the TTY Forum, but did not attend TTY Forum #18.

Bluegrass Cellular Inc.
Caprock Cellular Limited Partnership
Carolina West Wireless
Corr Wireless LLC
Dobson Cellular Systems
Farmers Cellular Telephone, Inc.
Great Lakes of Iowa inc.
Midwest Wireless Holdings L.L.C.
Pine Belt Cellular, In.c
PYXIS Communications
Qwest Wireless
RTSC Corporation, Inc.
Rural Cellular Corporation
Southern LINC
TeleCorp Communications, Inc.
TMP Corporation
Tritel Communications, Inc.

APPENDIX A

<u>AGREEMENTS REACHED AND ACTION ITEMS FROM TTY FORUM – 18</u>

18.1 Contribution TTY18/01.06.12.13, "Testing Against User Requirements" will be added to Appendix D: TTY Test Completion Matrix of the TTY Forum Meeting Summary.

18.2 The Secretariat will add contribution TTY18/01.06.12.13, "Testing Against User Requirements" to Appendix D: TTY Test Completion Matrix of the TTY Forum Meeting Summary.

18.3 Judy Harkins will provide the URL for the web site describing the testing tools technology to the TTY Secretariat to make the information more readily available to TTY Forum participants.

18.4 The list of questions regarding user intervention (Contribution TTY18/01.16.12.15), will be considered for further discussion of user intervention.

18.5 The product labeling issue will be deferred until the next TTY meeting due to time constraints.

18.6 Regarding Features and Functions:

CALL WAITING (CW)
- CW interferes with TTY communications.
- CW as a feature is disruptive and often not used by TTY users. Disabling CW by default for phones in TTY mode is an acceptable solution to the consumer community.
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- SMS is a desired feature for the consumer community.
- Queuing of SMS messages during a TTY conversation is not supported in some networks.

18.7 Elizabeth Lyle will submit a written proposal for a consolidated report for submission to the FCC. This report will be posted to the TTY Forum web site.

18.8 The next meeting of the TTY Forum (#19) will be held September 26 at the ATIS Conference Center in Washington, DC.

18.9 TTY Forum #20 will be held December 11 at the ATIS Conference Center in Washington, DC.

<u>AGREEMENTS REACHED AND ACTION ITEMS FROM TTY FORUM - 17</u>

17.1 The TTY Forum recognized ATIS as its Secretariat and official sponsor.

17.2 Ericsson, Lucent, and Nokia will look into the voice quality issue in terms of IS 127-2 CDMA and TDMA and report back to the TTY Forum whether or not there is a problem.

17.3 Consumer groups will review the "user intervention" handset function and report back at the next TTY Forum on whether or not the function is considered a viable option.
17.4 It was agreed to disband the E-Protocol Working Group.
17.5 It was agreed that the TTY Forum would file an ex parte to the FCC to report the solution proposed by the E-Protocol Working Group and the action taken by the TTY Forum.

AGREEMENTS FROM TTY FORUM — 16

16.1 TTY Secretariat, Megan Hayes, will add a non-attending participants list of those who submit implementation status reports to the chair but were unable to attend the TTY Forum

16.2 The industry implementation status reports will be added as an appendix to the meeting summary (Appendix L). All written reports will be sent to the chair within ten working days following the forum. This agreement will be sent out the list serve to ensure that all TTY participants (past and present) are aware of the agreement. The final Meeting Summary will be submitted to the FCC and will become public record.

16.3 TTY Forum industry members find that it is not within the scope and purview to address the e-protocol issue at this time. However, the chair will pass the concept and recommendation to SDO's (e.g. T1P1, TR45)

16.4 A working group will be created to explore the e-protocol issue. There will be an effort to ensure that all industry sectors are represented.

AGREEMENTS FROM TTY FORUM – 15

15.1 Toni Dunne, NENA, will be the principle point of contact for coordinating with PSAPs at a point in carriers, infrastructure, and mobile handset vendors field testing.

15.2 The TTY Forum will hold its next meeting on October 24, 2000 (second choice is October 25, 2000) at Gallaudet University. Meetings thereafter will be held on an "as needed" basis. The summary of the report from the October 2000 meeting will be formally forwarded to the FCC with a cover letter written by the Co-Chairs. Furthermore, on a voluntary effort, carrier will post a status update on their Website and/or the TTY list serve on 3/01, 9/01, and 3/02.

AGREEMENTS FROM TTY FORUM – 14

14.1 Establish Appendix J which will be a "living" document of technical terms and organizations and Appendix J, also a "living" document of technical standards development essential to the TTY Forum's Scope.

AGREEMENTS FROM TTY FORUM – 13

13.1 Lucent announced they will distribute the TTY vocoder solution, royalty-free, to mftrs implementing the solution. Lucent noted that it is not relinquishing the patent rights, just making the solution available royalty-free.

AGREEMENTS FROM TTY FORUM – 9

9.1 The TTY Forum agrees to submit User Requirements to TR45 in December, 1998.

9.2 Appendix G will be created as a living document to identify membership of the TTY Forum Test Procedure Study Group that will meet to track test plan modifications, facilities, and dates, user expert, point of contact.

9.3 Appendix H will be created to identify the operational characteristics of TTY devices.

9.4 The TTY Forum will develop a list of TTYs that fall within the domain of reasonable operational characteristics to provide an informational guide for carriers. The list will be available to the public via web sites and mailings.

9.5 The TTY Forum agrees that IWF is broadly defined as a translation method to complete a call that is transparent to the user. The IWF is not limited to either voice or data. An IWF may not be confined to a single network but may be shared across multiple networks.

9.6 The TTY Forum agrees to submit the SRD for the 2.5 mm Jack to TR45 in December, 1998.

9.7 The TTY Forum agrees to submit the SRD for Circuit Switched Data to TR45 in December, 1998

AGREEMENTS FROM TTY FORUM – 8

8.1 The TTY Forum agrees that all testing will be done in test labs simulating field conditions.

8.2 The TTY Forum agrees that the short-term solution will now be referred to as voice-based solutions. The long-term solution is now referred to as data based solutions.

8.3 An experienced TTY user will be available at the beginning of lab testing to provide counsel or training, if necessary.

AGREEMENTS FROM TTY FORUM – 7

7.1 The TTY Forum should remain operational until solutions are provided and implemented for all digital technologies, to the satisfaction of the TTY Forum.

7.2 The baseline for the digital solution is wireless analog performance.

7.3 Accept Contribution #12 as a working document to represent the basis of the test plan. Test Plan as modified by the technology groups (CDG,UWCC,GSMNA) will be sent to all phone manufacturers. Test plan will measure the performance of various digital air interface technologies.

7.4 Where possible, VCO/HCO should be included in the testing, design, and availability of TTYs, cellular phones, and air interface technologies.

7.5 The TTY Forum will submit a request for a three month extension to the FCC.

AGREEMENTS REACHED AT TTY FORUM - 6

6.1 Any carrier not in compliance with the Consumer Notification Process established at TTY Forum should be brought to the attention of the TTY Forum for resolution.

6.2 Working Group #1 is officially dissolved having completed its initial charter. Any further testing results would be forwarded directly to the TTY Forum.

6.3 A lack of TTY technical standard has resulted in a variance of TTY performance levels manifested when used on digital networks. As such, in developing the "short-term" digital solution, certain least used models of TTY may not be supportable on all digital air interfaces.

5.1 As an initial step, carriers who can offer TTY users at least one digital phone model for each digital technology that a carrier offers at a reasonable price by October 1, 1998 would be considered in compliance of the E9-1-1/TTY compatibility requirements.
5.2 The FCC can use the information contained in the notification letter in any way they feel would expedite getting the information to the consumer.
5.3 All test results submitted will be included in the next Quarterly Status Report.

AGREEMENTS REACHED AT TTY FORUM - 4

4.1 Objective test (Throughput Test) approved and to be sent to manufacturers and carriers with a matrix to record testing completion dates and documentation.
4.2 TTY Forum Test Completion Matrix approved.
4.3 Consensus reached that Testing Matrix should go to every manufacturer listed at CTIA as well as Wireless and Wireline Carriers. CTIA/PCIA will escalate/elevate TTY Forum efforts to reach wireless equipment manufacturers and inform of urgency and criticality of rapid
response to the Testing Matrix via a letter from the TTY Forum and CTIA/PCIA. The group recognizes that participation is voluntary. Copies of letter and matrix responses will be sent to the FCC.
4.4 RFI will be put on issues list to explore possibility of interference between phone and TTY device.
4.5 Consensus to put TTY Forum's current research opinion on output voltages (coupling information) into a formal document and present to manufacturers for feedback. Give 30 days for feedback.
4.6 Subjective test (End User Test) to be finalized by committee. Testing will be handled through Gallaudet with assistance from Wireless manufacturers and TTY manufacturers. Will replicate authentic 9-1-1 calls with a deaf/hearing impaired caller and a trained calltaker.
4.7 CTIA will produce a list of Analog Phones that are compatible with TTY devices to be included in notification efforts and on web sites due as a Contribution at the next TTY Forum.
4.8 Gallaudet University and Consumer groups will draft a Consumer Requirements Document due as a Contribution at the next TTY Forum.
4.9 CTIA/PCIA will send letter to wireless equipment manufacturers requesting that they support Gallaudet University in their testing efforts by sending equipment.
4.10 Standards Requirements Documents (SRD) due for V.18 and the 2.5 mm jack as Contributions at next TTY Forum.

AGREEMENTS REACHED AT TTY FORUM - 3

3.1 6 sponsored spots for identified consumer groups, relinquished if member misses 2 consecutive meetings.
3.2 Accept modified "readability test" to be used by phone manufacturers to benchmark TTY over digital capabilities, to determine success rate for transport. (See Contribution TTY/98.02.11.06) Two tests: Manufacturers Readability Test, End User Test

3.3 Error rate is defined as "character" not "bit" for the purpose of this forum. (Shift error rate of ratio 1/8 (i.e. 1 shift error causes up to eight text errors and will be counted as such) to be determined)

3.4 Develop User Requirements Document. The outcome of Working Group #2. Represents the effort to provide for future advancements in technology by looking at solutions beyond 45.45 baud, Baudot.

3.5 Define process to update Notification Document: refer updated information to CTIA to be distributed to T-CAT.

AGREEMENTS REACHED AT TTY FORUM - 2

2.1 Combine Working Group #1 and Working Group #3. Develop new set of deliverables based on the October 1, 1998 deadline.
- Short term solution: solve for backward compatibility.
- Develop Standard Test to measure error rate of TTY over digital.

AGREEMENTS REACHED AT TTY FORUM - 1

1.1 "Solve for 45.45 Baudot, not to preclude looking for other solutions."
- Look for long term and near term solutions.
  - Near term - send through vocoder
  - Long term - circumvent vocoder, enhance quality and connectivity
- Provide for the analog function of wireless phones.
- The only body that can change the agreements reached is this body. All agreements remain intact until/unless action is taken in this forum.

APPENDIX B

Recommended Text
Consumer Notification

ATTENTION TTY USERS

Background

A TTY (also known as a TDD or Text Telephone) is a telecommunications device that allows people who are deaf, hard of hearing, or have speech or language disabilities to communicate by telephone. A TTY has a keyboard used to type a conversation, which then is transmitted as tones over a wired telephone line. The tones are translated to text that appears on a person's TTY screen.

911 and TTY Access Through Wireless Services

Federal law requires the telecommunications industry to provide a way for TTYs to communicate through **wireless systems** to make 911 calls. There are two types of wireless phones – analog and digital.

- Analog – It is possible today to use some analog wireless phones reliably to call 911 with a TTY.

- Digital – It is not possible today to use a digital wireless phone reliably to call 911 with a TTY.

Research is being done to improve the ability of digital phones to work reliably with TTYs. The industry is working to resolve this matter by October 1998.

[Optional: For more information, contact . . .]

DATE OF PUBLICATION:

APPENDIX C

TTY Forum Issue Statements

6.1   The TTY Forum doesn't support one solution over the other but it seems that the 2.5 mm jack is preferred

6.2   It is acceptable in concept to retrofit the TTY at no cost to the user. Concern was expressed regarding warranty work, and who would perform work on equipment. The retrofit should not eliminate or impact any functionality previously available to the user. Time to retrofit should be reasonable. A liaison should be established between manufacturers and user groups to ensure "certain conditions" are met.

6.3   The issue of the false propagation of errors, created by the incorrect receipt of a shift character should be addressed through use of an appropriate test script. The script should contain multiple shifts space apart so that a realistic distribution of character errors would result, based on frequent (although not universal) practice of correcting shift errors by user action. A normal distribution between 1 and ? with a median of about 8 would be appropriate.

9.1   The issue of whether less than full rate transmission is an acceptable solution, if it can be shown to provide improved CER performance.

9.2   The User Requirements Document will be modified by the consumers before the December TR45 meeting.

APPENDIX D

TTY FORUM MANUFACTURER TESTING COMPLETION MATRIX

Manufacturer	Technology	Through Put Test (Contribution)	Type of Test (Field, Lab)	Contact Name & Number
Philips	Analog	98.07.21.07		Ken Wells
Motorola	Analog	98.05.20.20	Lab	Paul Mollar
Sendele	Analog	98.07.21.05	Lab	Steve Sendele
Motorola	CDMA	98.05.20.20	Lab	Paul Mollar
Lucent	CDMA	98.05.20.10	Lab	Ahmed Tauf
Lucent	CDMA	No Gain Solution 99.01.26.09	Lab	Dr. Steven Benno
Lucent	CDMA	99.09..09.16	Fixed Point Proof / Concept	Dr. Steven Benno
Nokia	CDMA	98.05.20.17	Lab	Mohamed El-Rayes
Qualcomm	CDMA	98.05.20.12	Lab	Nikolai Leung
Motorola	CDMA	99.05.18.15	Lab	
Ericsson	GSM	98.02.11.07	Lab	Christopher Kingdon
Nokia	GSM	98.05.20.17	Lab	Mohamed El-Rayes
Motorola	GSM	98.05.20.20	Static	Paul Mollar
Ericsson	GSM	98.11.04.14	Static	Steve Coston
Ericsson	All Digial	99.09.09.12 / .13	Static	Steve Coston
Nokia	GSM/TDMA	99.09.09.15	Theory	Doug Neily
Ericsson	TDMA	98.02.11.05	Lab	Christopher Kingdom
Ericsson	TDMA	99.01.26.10	Field	Steve Coston
Motorola	TDMA	98.05.20.20	Field	Paul Mollar
Nokia	TDMA	98.05.20.17	Lab	Mohammed El-Rayes
Philips/CPT	TDMA	98.07.21.07	Field	Jim De Loach 510-445-5510
Lober & Walsh	TDMA	98.09.08.10	Lab	Josh Lober
CPT	TDMA	98.07.21.08	Lab	Josh Lober
Ericsson	TDMA	98.11.04.14	Static	Steve Coston
AWS	TDMA	99.05.18.11	Static	Adrian Smith
NOKIA	TDMA	99.05.18.14	Lab	Massoud Fatini
Lucent	TDMA/CDMA	99.05.18.13	Lab	Steve Benno
Ameriphone	TDMA/CDMA	99.05.18.12	Static	Peter Lee
Lober & Walsh	IDEN	98.09.08.11	Lab	Josh Lober

Notes on Evaluating Solutions against the User Requirements List

Judy Harkins and Norman Williams, Gallaudet University, May, 2001

Some of the carriers have indicated a need to include in their tests and evaluations all of the user requirements generated in 1998 in the TTY Forum. This document annotates the requirements with notes about evaluation issues and field test procedures from a user perspective. This is obviously not a test plan but is sent out primarily for generating discussion and giving general guidance from the user viewpoint.

1. The character error rate should approximate that of AMPS, which has been demonstrated at <1% for stationary calls. More research on AMPS performance with TTY would be useful to assist in specifying a range of conditions.

See appendix.

2. The TTY caller must be able to visually monitor all aspects of call progress provided to voice users. Specifically, the ability to pass through sounds on the line to the TTY (so that the user can monitor ring, busy, answered-in-voice, etc.) should be provided.

Suggestion: Generate all audio call progress signals (ringing, busy, fast busy, voice answer) and determine if there is an understandable visual indication for each. The line status light on the TTY will probably function appropriately in voice channel solutions, but this should be verified. Check that the visual indication is synchronized in time with the audio indication.

Comment: A particular issue in wireless telecommunications is that call to mobile phones often do not ring at all if the party is unavailable; a voice message is provided instead. There may not be a visual indication of the call status on the telephone. Another issue is that many phones revert to voice mail. In these situations, the TTY caller will not be able to monitor all aspects of call progress provided to voice users.

3. There must be a visual indication when the call has been disconnected.

Suggestion: Place call and have other side hang up. What visual indication is given? If the user can tell, by looking at the handset for example, that the call is terminated, then this criterion is met.

Comment: It would help all users to have an explicit message, but if this is not provided, the user should know what the screen will look like upon call termination.

4. A volume control should be provided.

Comment: Determine and document the optimum volume control setting for the TTY being tested. (If performance is affected by volume control, users will need to be informed of this, and how to use the volume control to obtain a low error rate.)

5. The TTY user must have a means of tactile (vibrating) ring signal indication.

Suggestion: Verify that the handset or accessory vibrates on receipt of calls (and preferably not at other times!). Can the tester receive calls in a timely fashion with the ringer turned off? (Test throughout the call; some external vibrators continue to vibrate throughout a call, which can be confusing.)

6. The caller must be able to transmit TTY tones independent of the condition of the receiving modem. (This is to permit Baudot signaling by pressing a key, to let a hearing person know that the incoming call is from a TTY.)

Suggestion: On outgoing call, press keys on the TTY during ring signals and immediately after answer. Baudot tones should be clearly audible by the answering party. (This should not be a problem for voice channel solutions, but is worth some quick tests in the field.)

7. The *landline* party's TTY must not require retrofitting in order to achieve the desired error rate.

Comment: This issue appears to be moot and does not need to be tested.

8. The *wireless* party's TTY may require retrofitting, or a new model TTY to be developed, or the use of a portable data terminal such as a personal digital assistant.

Comment: This is not an issue for testing. However, if an accommodation is required, such as retrofitting, a special model, or a cable, this should be well documented so that consumers know what types of equipment they will need. If PDAs or paging devices are used in place of a handset and TTY combination, attention will need to be paid to the rate of input that can be achieved through the keyboard or virtual keyboard.

9. VCO and HCO should be supported.

Suggestion: Evaluating the efficacy of VCO and HCO:
*   VCO and HCO should be tested as they will be implemented. For example, if a custom cable is needed, tests should be run with that cable as part of the set-up. If the user needs to take action between turns (e.g., pushing a button), it should be tested with consumers to check usability.
*   Does the system deliver acceptable error rates with devices on the market that are designed to work in VCO and in a mobile environment? (Ameriphone Q90, Krown Pocket VCO, and the Ericsson handset adapter are the three known examples.)
*   Is the quality of voice on VCO calls the same as on non-TTY calls? This can presumably be tested using standard industry methods for voice quality.
*   Is there any delay or cut-off of characters or words when switching between voice and TTY?
*   Is there greater chance of disconnect when switching between voice and TTY? Other problems?

10. Reduction of throughput (partial rate) on Baudot is highly undesirable and should not be relied upon to achieve compliance (see #7). It may be useful as a user-selectable option to improve accuracy on a given call.

This issue is now moot, and no tests are needed.

11. Call information such as ANI and ALI, where provided in wireless voice, should also be provided for TTY calls.

This would not appear to be a problem on voice channel solutions. On data channel solutions, the call would need to carry the same identifying information as would be carried were it in the voice channel.

12. On the landline side, the solution need not support little-used or obsolete TTY models, but in general should support the embedded base of TTYs sold over the past ten years. The landline equipment supported must not be limited to that used in Public Service Answering Points (911 centers).

A variety of TTY models should be tested, but the amount of testing on each model will necessarily vary. The difficulty in testing with a large number of models is acknowledged, given the limitations in data capture possibilities with TTYs and some 911 TTY systems on the market. This may have to be handled by short tests – calling to direct-connect landline TTYs set to auto answer, where the tester can call send a string of identifying information about the call, which can then be sent back to the tester for scoring. This might be able to be arranged at Gallaudet if there is interest; more discussion is welcome. (Note that Gallaudet has produced some software tools and documentation for partially automated two-way tty testing: www.tap.gallaudet.edu/ttytools

13. Drive conditions must be supported, again using AMPS as a benchmark.

Tests for drive conditions should be run using carriers' individual methodologies and facilities. The consumer's goal is to be able to use the TTY and telephone while a passenger in a car, while on a train, etc.

Appendix User Requirement 1: Error rate of TTY over Wireless telephones

- Interoperability among handsets and infrastructure vendors should be tested using industry's usual tests.

- Varying signal conditions need to be tested.

- Varying network conditions need to be tested.

- Data should be collected and scored on both sides (directions) of the call wherever possible.

- See Requirement 12 on accommodating a range of TTY models. Compatibility testing with 9-1-1 TTY equipment should be coordinated via Toni Dunne.

- See Requirement 13 on drive tests.

- Calls through relay should be placed. A hearing person on the landline side should read one side of the script. (This is an example of where random characters will not be helpful). Relay operators cannot retain conversations; unless special arrangements can be made with TRS providers for test calls, the only way to ascertain is to ask the relay operator if the incoming text was garbled.

- We tentatively recommend that Lober and Walsh's SCORE program be used as this was developed through the TTY Forum. There is some indication based on limited tests that the Ericsson program results in a higher error rate.

- Scripts: A few comments -- Consumers have had the concern that the error rates generated by the TTY Forum's random character set may be inflated due to the excessive number of register shifts (sending a shift character between each figure/letter transition) in this script. It is not possible to eyeball the results in the field because of the random characters. The random character file also transmits only at full rate – there are no pauses.

  Matt Kaltenbach of Ericsson has suggested that it would be helpful to base at least one script on the bit structure of Baudot or some other mathematical basis that would allow for diagnosis of problems in the field.

  Gallaudet has produced a series of scripts that use conversational language and naturals shifts between letters and figures, pauses in typing and simulation of two typing speeds. These are available at http://tap.gallaudet.edu/ttytools

  - Comment on the 1% benchmark: It was our intention, when we wrote this requirement, that 1% would apply to reasonable signal conditions and network conditions, and *not* that a maximum of 1% error rate must be met on every single call in the presence of severe (and rarely occurring) impairments.

APPENDIX E

TTY USER REQUIREMENTS

September 10, 1998

To: TTY Forum

Fr: Consumer Representatives

The CTIA has said that most of the consumer criteria previously submitted were not usable by the TTY Forum because the criteria covered marketing and distribution as well as design. Marketing and distribution issues for a possible "one-phone-model-per-technology" short-term plan will be taken up with CTIA's senior management, as suggested by them.

This contribution is a new set of criteria to address only functional characteristics of the solutions. The new criteria also reflect new information from the Forum since the first list was drawn up. It is intended to cover any solution.

1. The character error rate should approximate that of AMPS, which has been demonstrated at <1% for stationary calls. More research on AMPS performance with TTY would be useful to assist in specifying a range of conditions.

2. The TTY caller must be able to visually monitor all aspects of call progress provided to voice users. Specifically, the ability to pass through sounds on the line to the TTY (so that the user can monitor ring, busy, answered-in-voice, etc.) should be provided.

3. There must be a visual indication when the call has been disconnected.

4. A volume control should be provided.

5. The TTY user must have a means of tactile (vibrating) ring signal indication.

6. The caller must be able to transmit TTY tones independent of the condition of the receiving modem. (This is to permit baudot signaling by pressing a key, to let a hearing person know that the incoming call is from a TTY.)

7. The *landline* party's TTY must not require retrofitting in order to achieve the desired error rate.

8. The *wireless* party's TTY may require retrofitting, or a new model TTY to be developed, or the use of a portable data terminal such as a personal digital assistant.

9. VCO and HCO should be supported where possible.

10. Reduction of throughput (partial rate) on Baudot is highly undesirable and should not be relied upon to achieve compliance (see #7). It may be useful as a user-selectable option to improve accuracy on a given call.

11. Call information such as ANI and ALI, where provided in wireless voice, should also be provided for TTY calls.

12. The solution need not support little-used or obsolete TTY models, but in general should support the embedded base of TTYs sold over the past ten years. The landline equipment supported must not be limited to that used in Public Service Answering Points (911 centers).

13. Drive conditions must be supported, again using AMPS as a benchmark.

September 14, 1999

To: TIA TR-45.3

Fr: Consumer Representatives, Wireless TTY Forum
        Authors: Judy Harkins, Gallaudet University and Dick Brandt, dB Consulting as
        consultant to Gallaudet
        David Baquis, Self Help for Hard of Hearing People, Inc.
        Alfred Sonnenstrahl, Consumer Action Network
        Claude Stout, Telecommunications for the Deaf, Inc.
        Karen Peltz Strauss, National Association of the Deaf
        Norman Williams, Gallaudet University

Re: Guidance to TR-45 on Proposals for Solutions to TTY over TDMA

Presentations on three of the proposals being considered by TR-45 for the TDMA TTY solution
were made at the September 9, 1999 meeting of the Wireless TTY Forum. Given the timeframe
TR-45 is operating under, and given that the FCC has directed industry to consider consumer
issues in determining solutions, we offer this document as guidance to TR-45 as it considers the
alternatives.

The information presented at the September 9 meeting was, in some cases, sufficiently sketchy
that consumers were unable to ascertain the functional implications of the proposals. Some
presentations were also done very late in the process, so there is not sufficient time for analysis.

We do not state a preference for any proposal but hope the following discussion will be helpful.

General Questions and Issues:

1. There is a concern among consumers about the implications of roaming among digital
    technologies in the future, if a variety of approaches for TTY access are used. Thus we
    believe consistency in approach across technologies is needed. One of the carriers also
    strongly expressed this view. This problem needs to be solved for the long term, not just for
    the current situation where roaming tends to go to the more-accessible analog network. Once
    these solutions are implemented, if problems arise, consumers will have great difficulty
    having them addressed because the solutions are within the network and customer service
    personnel will not be equipped to deal with them.

2. Has there been any analysis indicating that approaches which propose network changes in
    switches versus changes in base stations, would lead to earlier availability as claimed?
    Consumers are interested in seeing solid, lasting and effective solutions, and the speed of
    implementation, while important, should not override usability considerations.

3. All test results presented to date have been obtained using blocks of data sent out from a file
    stored either in a TTY or in a computer and sent via a TTY modem. It has been noted in tests
    run by Gallaudet that results obtained in an interactive mode (two people typing to each

other) yielded poorer accuracy. Thus proposals that show errors in transmission should be scrutinized carefully. A full range of system impairments has either not been used in simulation testing or not reported on all of the solutions.

4. Non-activated phone support for 9-1-1 calls is required by the FCC. Has this been considered in the proposals? (See class mark discussion below.)

Appraisal of Specific Solutions:

Vocoder solution. From a consumer perspective, the Lucent "no gain" solution has been most thoroughly presented and appears to have the most transparent accessibility and the most support for consumer needs and requirements. The inclusion of error correction is a major benefit, given that the air interface presents new challenges to TTY transmission. Other, comparable proposals may also have merit (e.g., Nokia), but they have not been thoroughly explained so that consumers can compare them.

Code conversion. The Ericsson (and Nokia?) Code conversion ("tone") proposals appear to offer the possibility of earlier implementation (see 2 above) and the ability to use many existing handsets, but have the potential of putting the retrofit burden on the consumer. They raise the following concerns:

1. Smart Cable: Consumers are not opposed to the idea of including intelligence in the cable per se, however the following concerns exist:
   1.1. How would this intelligence be powered? (This question could not be answered at the Sept. 9 meeting.) There is opposition to the requirement for an additional battery for reasons of cost, bulk, and reliability.
   1.2. Who would make and provide the cable?
   1.3. Would this intelligence be built into the regular cable product line or would this be a primarily or exclusively "deaf" product? If the latter, experience shows that provisioning and cost may be serious problems. Customers often have to wait many weeks for "special" accessories. We realize standards bodies do not ordinarily address cost issues, but please consider the additional cost of a phone that vibrates (over a low-end phone), the cost of the TTY, and now the potentially high cost of a special-purpose cable with a small market.
   1.4. Would one cable fit all (thereby lowering the price and expanding the availability)?

2. Class Mark: Any system that relies on the phone having a class mark denoting that the user uses a TTY is not likely to be successful, because many deaf and hard of hearing people consider self-identification as a possible threat to their security. 9-1-1 operators have never been successful in having deaf and hard of hearing subscribers "sign up" as a TTY telephone number. The procedure is fraught with potential problems and snafus. When someone roamed into a carrier using this solution (not marked), what would happen? Hearing people who use TTYs may not realize they need to enroll their phones. People who have a phone and acquire a TTY later (e.g., after onset of hearing loss) would find the TTY does not work. TTY users could not use someone else's cell phone. One solution to this problem suggested at the forum was to mark all phones as TTY. Would carriers agree to this? In short, a system that provides automatic detection of the TTY signal is preferable.

IWF.   Although we recognize that IWF proposals are not a part of the present TR-45 TDMA TTY discussions we would also like to provide the following for your information, as they should be considered in development of proposals:

1. There is a strong desire for VCO/HCO capability, which appears to be difficult to implement in IWF solutions at the present time.
2. There is also a strong desire for provision of the line signal power indicator (flickering light) used to interpret call status.
3. Consumers are opposed to (and the DOJ has mandated against) requiring any form of special dialing (e.g., two-stage) or conditioning sequences (e.g., #NN) to reach 9-1-1.
4. It will be important that the delay between powering on a data device and dialing out not exceed the delay experienced with a voice call.

Appendix: Consumer requirements with comments regarding proposed solutions:

1. The character error rate should approximate that of AMPS, which has been demonstrated at <1% for stationary calls. More research on AMPS performance with TTY would be useful to assist in specifying a range of conditions.

Comment: All proposals presented to date appear to meet this criterion. Consumers are concerned that there be sufficient testing to validate this in the field.

2. The TTY caller must be able to visually monitor all aspects of call progress provided to voice users. Specifically, the ability to pass through sounds on the line to the TTY (so that the user can monitor ring, busy, answered-in-voice, etc.) should be provided.

Comment: All proposals claim to meet this criterion and we have no concerns. (IWF solutions may, however, not be able to meet this one.)

3. There must be a visual indication when the call has been disconnected.

Comment: This specific issue has not been addressed in presentations but is covered by most if not all systems by a message on the display of the phone.

4. A volume control should be provided.

Comment: This item is intended to allow the TTY user to adjust volume for better reception of TTY tones as necessary. Most if not all handsets include this feature anyway. It has not therefore been addressed in presentations on solutions.

5. The TTY user must have a means of tactile (vibrating) ring signal indication.

Comment: Again, this is an issue of general provisioning and not related to voice-channel solutions. (However, this will be an issue in IWF solutions.)

6. The caller must be able to transmit TTY tones independent of the condition of the receiving modem. (This is to permit Baudot signaling by pressing a key, to let a hearing person know that the incoming call is from a TTY.)

Comment: All voice-channel solutions to date appear to support this.

7. The *landline* party's TTY must not require retrofitting in order to achieve the desired error rate.

Comment: All solutions to date appear not to require retrofitting of the landline TTY.

8. The wireless party's TTY may require retrofitting, or a new model TTY to be developed, or the use of a portable data terminal such as a personal digital assistant.
Comment: Solutions that do not require retrofitting or special treatment are preferred by consumer representatives.

9. VCO and HCO should be supported where possible.

Comment: Voice-channel solutions presented to date appear to support this requirement. (IWF solutions may not, however.)

10. Reduction of throughput (partial rate) on Baudot is highly undesirable and should not be relied upon to achieve compliance (see #7). It may be useful as a user-selectable option to improve accuracy on a given call.

Comment: No solution presented to date reduces throughput, as nearly as we can tell. This should be verified with the companies proposing solutions.

11. Call information such as ANI and ALI, where provided in wireless voice, should also be provided for TTY calls.

Comment: Voice channel solutions should not cause a problem with this.

12. On the landline side, the solution need not support little-used or obsolete TTY models, but in general should support the embedded base of TTYs sold over the past ten years. The landline equipment supported must not be limited to that used in Public Service Answering Points (911 centers).

Comment: This is of concern because of limited testing of solutions to date.

13. Drive conditions must be supported, again using AMPS as a benchmark.

Comment: This requirement has not been adequately addressed by testing.

APPENDIX F

WORK PLAN

Published as a separate TTY Form Document

APPENDIX G

Typical Operating Characteristics for Wire-Line Based TTYs

The following is a technical description of the typical operating characteristics for existing wire-line based Text-Telephones for the Deaf (TTYs). This document is not intended to be a performance description of any one product, but to give a representation of performance of the majority of the product supplied to wire-line TTY customers in the last five years. TTY manufacturing representatives has reviewed this information and agrees that it represents an accurate account of the performance characteristics of existing wire-line products.

It should be noted that it is not possible to precisely define performance for all products, in all situations, in the field. Variation beyond this technical representation does exist for older product, products that are no longer supported by a manufacturer, individual products that are not operating correctly and improper use of product. It is not possible to report this additional range of variation, only to say that these products performance would suffer on either a connection to wire-line or wire-less TTY.

TECHNICAL BACKGROUND
For Frequency Shift Keying (FSK) two signal frequencies are required to modulate the asynchronous serial data to be sent over the conventional voice grade telephone lines of the switched telephone network. For Baudot communications to be useful on the Public Switch Telephone Network (PSTN) these frequencies fall within the central portion of the telephone line pass-band (300 – 3300 Hz).

The two frequencies of the transmitted signal must be sent in accordance with FCC requirements defined in dBm (decibels with reference to a power of one milliwatt for metallic connections, where 0 dBm = 1 milliwatt). The acoustic measurements are in dBSPL for acoustic configurations. This signal is measured at the TTY interface, either at the metallic connections or where it is acoustically coupled to the telephone network.

The receive level, commonly referred to as sensitivity, is also given for each pair of frequencies. This signal, also measured in dBm for direct connections and dBSPL for acoustic configurations, is the typical signal measured at the connection that will result in error-free reception of a test message.

BAUDOT CODE OPERATION

All TTYs provide Baudot code operation employing half-duplex, simplex, asynchronous, FSK transmission.

Frequencies

Baudot code operation used the following frequencies:

Signal	Frequency	Tolerance	
		Transmit	Receive
Mark	1400 Hz	±1%	±4%
Space	1800 Hz	±1%	±4%

Bit Duration

The bit duration is 22.00 milliseconds (ms) ±0.40ms to provide a nominal baud rate of 45.45 bits per second.

CHARACTER FORMAT

Transmit

The Baudot code for each character is transmitted with the following format, the data bits assigned are in accordance with Table 1.2 with a "1" in the binary representation transmitted as a mark and a "0' as a space.

Bit	Start	Data	Data	Data	Data	Data	Stop
Signal	Space	LSB	Bit 2	Bit 3	Bit 4	MSB	Mark
Number of Bits	1	1	1	1	1	1	1.5-2.0 2.0 Typ.

Table 1.1

Where the LSB is the Least Significant Bit and the MSB is the Most Significant Bit. The bits shall be transmitted from left to right.

Receive

The TTY is capable of receiving characters with the format of Table 1.1 with a stop bit of at least 1.0 bit length or longer. The receiver is capable of receiving characters either with the space tone of the start bit as the first tone received or with a mark tone preceding the start bit.

Mark Hold Time

The mark hold time defines an additional period of time during which the TTY transmits a mark hold tone (1400 Hz) following the last character transmitted. Mark hold tone is not transmitted between each character if the character is followed immediately by another character. The mark hold tone is transmitted for a period between 150ms to 300 ms after the end of the stop bit(s).

Transmit Levels		
Coupling Method	Level	Range
Acoustic Direct Connect	108 dBSPL -10 dBm	±6 dB * - 3 ,+1 dB

Sensitivity Levels		
Coupling Method	Level	Range
Acoustic Direct Connect	72 dBSPL -40 dBm	±6 dB * ±5 dB

Most receivers are capable of receiving signal up to at least –5dBm.

* NOTE: Acoustic performance variations greater than listed may be encountered and are a result of many variables including the type of telephone handset used and how well the acoustic coupling is made by the user. It is not possible to report this additional range of variation, only to say that these products performance would suffer on either a connection to wire-line or wire-less TTY.

TABLE 1.2

Set of Baudot Codes for TTYs

DEC	HEX	BINARY	LETTER	FIGURE
0	00	00000	BackSpace	BackSpace
1	01	00001	E	3
2	02	00010	LF	LF
3	03	00011	A	-
4	04	00100	Space	Space
5	05	00101	S	
6	06	00110	I	8
7	07	00111	U	7
8	08	01000	CR	CR
9	09	01001	D	$
10	0A	01010	R	4
11	0B	01011	J	'
12	0C	01100	N	,
13	0D	01101	F	!
14	0E	01110	C	:
15	0F	01111	K	(
16	10	10000	T	5
17	11	10001	Z	"
18	12	10010	L	)
19	13	10011	W	2
20	14	10100	H	=
21	15	10101	Y	6
22	16	10110	P	0
23	17	10111	Q	1
24	18	11000	O	9
25	19	11001	B	?
26	1A	11010	G	+
27	1B	11011	FIGS	FIGS
28	1C	11100	M	.
29	1D	11101	X	/
30	1E	11110	V	;
31	1F	11111	LTRS	LTRS

Note: CR and LF may be manually or automatically generated by the TTY. If automatic generated, the sequence may contain an extra (non-printable) character to provide adequate time for older electromechanical TTYs to respond. CR & LF are inserted into the transmitted characters after a maximum of 72 characters to allow for the carriage return of older electromechanical TTYs.

APPENDIX H

Modem / IWF Manufacturer Contact List

List of Names and Addresses to Receive IWF Letter

Title	FirstName	LastName	JobTitle	Company	Address	Address2	City	State	Zip
Ms.	Veda	Krishnan		Cirrus Logic	110 Horizon Drive #300		Raleigh	NC	27615
Mr.	Zarko	Draganic	CEO	Alto Com Inc.	257 Castro Street	Suite 233	Mountain View	CA	94041
Mr.	Edward	Campbell		3Com					
Mr.	Raouf	Halim	VP and General Manager, Network Access Division	Rockwell Semiconductor Systems	4311 Jamboree Road		Newport Beach	CA	92660-3095
Mr.	Aaron	Fisher	Vice President , Wireless Products	Lucent Technologies	Room 55F-311	1247 S. Cedar Crest Blvd.	Allentown	PA	18105-6209
Ms.	Judy	Sheff	VP Intellectual Property	Lucent Technologies	Room 5SF18	2 Oak Way	Berkeley Heights	NJ	07922-2747
Mr.	Greg	Garen	General Manager Modem and Multimedia Products	Lucent Technologies - Microelectronics Group	Room 22W-219(Mail Stop EQ)	555 Union Blvd.	Allentown	PA	18103-1229
Mr.	Warren	Henderson	CEO	Henderson Laboratories					
Mr.	Moiz	Beguwala	VP and General Manager, Personal Computing Division	Rockwell Semiconductor Systems	4311 Jamboree Road		Newport Beach	CA	92660-3095

CC: National Association of State Relay Administration (NASRA)
Merilyn Crain, Chair
315 So. College Rd. Suite 208
Lafeyette, LA 70503

IWF letter dated November 16, 1998

Sent to:
3Com
Mr. Zarko Draganic, CEO, Alto Com Inc.
Ms. Veda Krishnan, (to be supplied) Cirrus Logic
Mr. Aaron Fisher, Vice President, Wireless Products, Lucent Technologies
Ms. Judy Sheff, VP Intellectual Property, Lucent Technologies
Mr. Greg Garen, General Manager Modem and Multimedia Products Lucent Technologies -
Microelectronics Group
(To be supplied), Motorola
Mr. Raouf Halim VP and General Manager, Network Access Division, Rockwell Semiconductor
Systems
Mr. Moiz Beguwala, VP and General Manager, Personal Computing Division, Rockwell
Semiconductor Systems

Dear Sir/Madam

In response to a FCC inquiry, the Cellular Telecommunications Industry Association (CTIA) and
the Personal Communications Industry Association (PCIA) have established a technical forum to
address the issue of providing reliable communications for deaf and hard of hearing people over
digital wireless systems. Specifically this forum is addressing the issue of deaf and hard of
hearing people using digital wireless connections to access 9-1-1 centers.

A solution that appears to offer promise for the longer term, involves the use of new (or
modified) communications terminals, used by deaf and hard of hearing people, (TTYs)
connected through a serial interface to the digital cell phone. The data channel, provided by the
air interface, would then be used to effectively extend this interface to the network. This of
course, would require the use of an Interworking Function (IWF)*[1] in the network that would be
capable of supporting TTY communications. We are aware that some of the IWFs being
developed will support 45.45 Baudot TTY transmission (the transmission mode most commonly
used by deaf and hard of hearing people in the United States). While this caters well to the
present need, it has the drawback that it locks deaf and hard of hearing people into this older
technology.

A more desirable solution would be one which would involve the use of ITU-T
Recommendation, V.18, that specifies a protocol, which provides for higher speed ASCII based
communications while at the same time maintaining compatibility with today's Baudot TTY
devices. The problem with this solution is that V.18 has yet to be implemented by any major
modem manufacturer. We have, however, been given a presentation by a UK based company
that has developed a prototype "stand alone" V.18 product which it plans to introduce
commercially early next year. In addition to this, we have been given a demonstration of an in-
service Swedish IWF, which incorporates V.18 functionality. It might also be of interest to note
that the service provider sees text telephony as a generic service (e.g. not just for deaf or hard of
hearing). These two events may be moving V.18 into the readily achievable category.

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[1] The term IWF is used in its broadest sense in this letter. (See the definition in TIA TSB-100)

It seems likely that if the IWF function and the modems installed at the 9-1-1 centers were to incorporate V.18 capability, connections could be made at the higher V.18 rates. Likewise it would appear that the connect time could be shortened as V.18 incorporates a calling tone, which could be instantly recognized by equipment at the 9-1-1 centers, thereby eliminating the loss of precious time, which is normally incurred while attempting to determine the source of a "silent" call.

Assuming that you agree that the timely provision of this functionality is important, we are hoping that you can provide us with an indication of when we might expect to see products (e.g. consumer modems, IWFs) from your company that implement V.18. Any information you could provide to us, by 4th Quarter 1998, would greatly help us in developing our response to the FCC.

APPENDIX I

TTY Forum Chair's Update Memorandums

Date: March 22, 1999

FM: TTY Forum Co-Chairs; Ed Hall, CTIA and Todd Lantor, PCIA
TO: TTY Forum Members and Interested Parities

RE: TTY Forum Update

Greetings,

A recent conversation with Dr. Steven Benno of Lucent Technologies has informed us that he has completed the Lucent software simulation of the TTY "no-gain" solution and it is now released and available to all those interested in exploring its functionality, compatibility and potential benefits with various CLEP vocoders. According to Dr. Benno, the following equipment and infrastructure vendors have requested a copy of his newly released code for testing purposes; Ericsson, Motorola, Nokia, NORTEL and Qualcomm. As co-chairs, we remain hopeful that this Lucent contribution will spark an interest for some manufacturers to re-visit their past efforts with vocoders, which perhaps may lead to follow-on contributions at our next TTY Forum.

During the last TR45 meeting, (March 3-4) CTIA submitted the 2.5mm Jack SRD, on behalf of the Forum. TR45 accepted this contribution and remanded it to the TDMA (TR45.3) and CDMA (TR45.5) sub-committees for information and to the appropriate sub-committee (TR45.1) for Action. Likewise, the TDMA and CDMA sub-committees reported back to the Chair that both of these digital technologies have developed standards supporting the Inter-working Function (IWF) as described in the TTY Forum's SRD on Circuit Switched Data submitted during the December TR45 meeting. This news brings the industry one step closer to the Forum's proposed "long term" data solution. The willingness of some modem manufacturers (3COM) to support the V.18 protocol is the other critical issue needed to make the IWF a viable option to carriers as a means of supporting TTY over digital - long term. The IWF solution opens the doors to the future by allowing end-users the use of ultra-light computers, compact PDA's, etc.

At this point I think it is important to remember that it has been the synergy, team-spirit and positive environment provided by the members of the TTY Forum that has lead us to this point. But, we do not want anyone to have the false impression that the end-all, be-all solution(s) have thus far been developed. Although Dr. Benno's "no-gain" solution remains a major breakthrough for TTY, "short term", voice based (specifically CLEP vocoders) solution and the V.18 protocol a major breakthrough for TTY "long term", data solution these by no means require carriers or manufactures to implement anyone one or both of these solutions. Keep in mind the other solutions brought to the Forum by Lober and Walsh and Ericsson. These solutions have also proved to be quite successful and promising for certain digital technologies. It is important to keep in mind that the carrier is responsible for the selection and implementation of a solution(s) that will allow TTY users to access 9-1-1 over its digital system. The best we as a Forum can do at this point is continue to provide the positive environment, feedback and input to manufacturers and carriers regarding testing and consumer needs and requirements and keep the standards development bodies involved when needed. CTIA and PCIA remain committed.

In conclusion, we propose that at the next TTY Forum we initiate the process to develop the final report to the FCC. Based on the contributions received to date and those anticipated at our next meeting, we believe we will have sufficient information to develop specific comments and recommendations. The TTY Forum can then plan to meet on a quarterly basis to "evaluate" progress and provide the FCC with a periodic, implementation status report.

My thanks to all members of the TTY Forum. Looking forward to seeing everyone in May.

July 23, 1999

Fm: TTY Forum Co-Chairs
TO: TTY Forum

RE: Update: TTY Forum and Interested Parties

Todd Lantor and I would like to take this opportunity to provide you with an overview of some interesting developments that have come to our attention since the last Forum held on May 18th, 1999.

The Lucent "no gain" vocoder solution has been widely accepted by TR45.5, the CDMA air-interface standards group. The "no gain" solution draft standards document has recently been prepared for ballot. Assuming a "clear" ballot response, the industry may have a CDMA TTY standard as early 4Q99. Likewise, TR45.3, the TDMA air-interface standards group is actively pursing the same course as the CDMA group. The Nokia variation, presented to the Forum during the May meeting is being reviewed and considered. The group plans to complete its deliberation quickly and move toward the final stages by preparing a draft document for ballot.

Ericsson has provided the co-chairs with a copy of a document that proposes an alternative approach to the Lucent "no gain" vocoder solution. In the interest of time, and to take advantage of the TR45.3 meeting cycle, Ericsson thought it prudent to submit the alternative approach directly to the TDMA working group. Although it is being discussed at standards, Ericsson will present this vocoder alternative at the upcoming September TTY Forum.

Concurrently, we are preparing a draft "TTY Forum Status Report" for the FCC. The report, as a minimum, will contain the following sections:
- Updated Work Plan
- TTY testing completed to date
- A Technical Standards Update
  - Voice Based Approach
  - Data Approach
- Comments and Recommendations

Todd and I plan on getting a draft of this report to the TTY Forum Steering Committee for their review and approval before the next TTY Forum: The Steering Committee is comprised of: Toni Dunne, Texas 9-1-1; Billy Ragsdale, Bell South; Claude Stout, TDI; Norm Williams, Gallaudet UN; Jeff Crollick, TIA; John Melcher, NENA.

Next Meeting: We are currently making arrangements for the **September 9**, **1999** TTY Forum and will get the meeting logistics out separately.

The meeting will be in the **Washington DC** area but WILL NOT be at Gallaudet Univ. Their calendar cannot support us. The meeting will start at **9:00 AM** and adjourn at 5:00 PM. Please do not make travel arrangements leaving the DC area before 6:30 PM. Now that we have reduced the meetings to one day, I see this Forum's agenda as being quite full.

Thank you all and have a very cool and pleasant summer. See you September!

Appendix J

Technical Standards Reference

ID	Description
TIA/EIA 825	FSK
TIA/EIA TSB-121	"2.5 mm AUDIO INTERFACE FOR MOBILE WIRELESS HANDSETS - TEXT TELEPHONES (TTY)"
TIA/EIA-IS-823 (PN-4614)	TR 45.3 5.3 TDMA TTY Solution- 410 vocoder
TIA/EIA-IS-840 (PN-4721)	TR 45.3 5.3 TDMA TTY Min Performance.
TIA/EIA/IS-789-A:	Electrical Specification for the Portable Phone to Vehicle
IS-733-1, IS-127-2	CDMA Vocoder Standards - high rate
IS-707-A-2	CDMA Data (V.18) Standard
TIA/EIA-136-270-B	TDMA Third Generation Wireless – Mobile Stations Minimum Performance
TIA/EIA-136-280-B	TDMA Third Generation Wireless – Base Stations Minimum Performance
3GPP TR26.226	Cellular Text Telephone Modem Description
3GPP TR26.230	Cellular Text Telephone Modem Transmitter Code
3GPP TR26.231	Cellular Text Telephone Modem Minimum Performance Specifications

Timeline of Events in CDMA and TDMA standards

CDMA: TIA TR45.5.1.1
=====================
August 2000: Lucent proposed bug fixes to the TTY/TDD addenda and proposed a TTY/TDD Minimum Performance Specification for CDMA.

November 2000: Nortel proposes to add a test vector to the Min Perf Spec in order to handle the hard handoff scenario. This scenario uncovers another bug in the code.

Dec 2000: Lucent proposes another bug fix, which is approved, but the subcommittee doesn't baseline the fixes in order to give more time to find problems.

Jan 2001: Updates to the TTY specifications and Min Perf Specs are baselined and sent to V&V.

TDMA: TIA TR45.3.5
==================
October 2000: Proposed bug fixes to IS-823 TTY Extension to TIA/EIA 136-410.

December 2000: Proposed additional bug fix similar to the bug fix proposed for CDMA in Dec. 2000.

January 2001: Nokia and Ericsson present contribution questioning the necessity of any bug fixes. Nokia proposes change to standard to improve TTY performance during signaling.

February 2001: A problem is found with IS-840 TTY/TDD Min Perf Spec for TDMA. Nokia (the editor) will provide an update to fix problem and update based on Nokia's proposed change to IS-823.

March 2001: Changes to IS-823 are approved. Nokia commits to having a new version of IS-840 for review by next meeting. The subcommittee decides to ballot new versions of IS-823 and IS-840 together.

APPENDIX K

Glossary of Terms

<u>Telecommunications Standards and Assignment Organizations</u>

ANSI - American National Standards Institute
> The ultimate accolade for any standard is ANSI certification. This does not mean that ANSI has reviewed the standard, but that it has been circulated widely throughout the industry and that it conforms to their document design and publication guidelines. TIA standards, for example, start their public life as an IS- (Interim Standard) and then proceed within a few years to a full ANSI standard. The analog cellular standard started as EIA/TIA IS-3 and is now the ANSI standard identified as EIA/TIA-553.

ATIS - Alliance for Telecommunications Industry Solutions
> The major US telecom standards organization beside the TIA, most responsible for ANSI SS7 standards. This organization was previously called ECSA; Exchange Carriers Standards Association. SS7 and wireless standards are developed within the T1 committee.

Bellcore - Bell Communications Research
> Bellcore is not a standards organization, but they do write technical documents that are treated as if they were standards by many telecommunications carriers, particularly their former owners, the 7 regional bell operating companies. These documents include the GR-145 specification for interconnect, enhanced SS7 specifications beyond ANSI and the WACS low-mobility PCS system. Bellcore also performs many other research and consulting functions.

ETSI - European Telecommunications Standards Institute
> The mission of ETSI is "to produce the technical standards which necessary to achieve a large unified European telecommunications market". This includes the specification of the GSM cellular and PCS standard.

IFAST - International Forum on ANSI-41 Standards Technology
> A forum on international cellular carriers, vendors and service providers that attempts to resolve international roaming problems with AMPS-compatible systems (i.e. including IS-136 D-AMPS and IS-95 CDMA). The organization has taken responsibility for allocating the International Roaming MIN resources (MIN's starting with the digits 0 or 1) and new blocks of SID codes.

INC - Industry Numbering Committee
> The Industry Numbering Committee (INC) is a standing committee of the Carrier Liaison Committee (CLC). The INC provides an open forum to address and resolve industry-wide issues associated with the planning, administration, allocation, assignment and use of resources and related dialing considerations for public telecommunications within the North American Numbering Plan (NANP) area.

ITU - International Telecommunications Union
> The ITU is the global equivalent of ANSI for telecommunications standards. In fact, the world is divided into the majority of countries that adhere to ITU standards, and the US and Canada that tend to use ANSI standards. AMPS cellular is an exception, as it has been implemented in many other countries. ITU standards that are used in AMPS

cellular include: E.164 - the global numbering plan. E.212 - the global mobile identification plan. Q.7xx - a series of standards defining Signaling System #7 (used as an alternative to ANSI SS7 in AMPS countries outside the US and Canada).

NANPA - North American Numbering Plan Administration

The organization responsible for allocating numbering resources within the North American Numbering Plan Area: USA, some of its territories, Canada and several Caribbean nations. Controlled by Bellcore until January 1998, it is now managed by Lockheed-Martin. It is responsible for assignment of new area codes within the North American Numbering Plan and office code assignments within US states and territories.

NENA - National Emergency Number Association

NENA, along with NASNA (National Association of State 9-1-1 Administrators), APCO (Association of Public Safety Communications Officials) and the TIA are responsible for promoting enhanced 9-1-1 standards for wireless systems.

TIA - Telecommunications Industry Association

WWITF – Wireline Wireless Integration Task Force

Government and Regulatory Organizations

Australian Communications Authority (ACA)

The organization responsible for the management of radio spectrum and telecommunications in Australia, formed by a merger of AUSTEL and SMA. APUMP represents people who are unhappy   with the decision to eliminate analog cellular by the year 2000 in favor of the three GSM systems.

RSP - New Zealand Radio Spectrum Authority

Responsible for the management of radio spectrum in New Zealand.

US Dept. of Commerce

The Office of Telecommunications provides a great online source of worldwide wireless telecommunications information.

FCC - US Federal Communications Commission

The organization responsible for the management of telecommunications in the United States. Their responsibilities for public radio communications, such as cellular, include allocation of frequencies, the development of regulations that govern their use and monitoring to ensure that regulations are followed.

Wireless Telecommunications Trade Associations

ATIS – Alliance for Telecommunications Industry Solutions

CTIA - Cellular Telecommunications Industry Association

A trade association of wireless carriers in the United States, Canada and other countries. Originally a cellular organization, it now has members that are Manufacturers, PCS, ESMR and Satellite carriers.

CWTA - Canadian Wireless Telecommunications Association

A trade association of wireless carriers in Canada.

MMTA - Multi-Media Telecommunications Association

An association of companies focused on computer-telephony integration. They announced in November 1996 that they were merging with the TIA.

PCIA - Personal Communications Industry Association

Formerly Telocator, this organization represents Paging, PCS, ESMR, SMR and mobile data service providers as well as communications site managers, equipment manufacturers, and others providing products and services to the wireless industry.

TIA - Telecommunications Industry Association

United States Telephone Association.

A trade association for US local exchange carriers.

Wireless Forums

CDG   CDMA Development Group

A trade association dedicated to the promotion of CDMA wireless technology.

MIPS   Mobile Internet Phone Services Forum

A new group dedicated to promoting the development of Internet access technologies, services and features from mobile devices.

PACS Providers Forum

PACS (Personal Access Communication System) is a PCS system based on Bellcore's WACS and Japan's PHS, that will provide 64kbps voice and data, but is restricted to low mobility applications.

Universal Wireless Communications Consortium

Promoters of the IS-136 TDMA digital cellular and PCS standards, mostly through conferences and symposiums.

WDF   The Wireless Data Forum is an independent, protocol-neutral trade group dedicated to promoting the wireless data industry. WDF's members include wireless operators and equipment providers, application developers and information technology companies working to advance wireless and mobile data products and services.

Glossary

Analog Signal A signal that varies in a continuous manner, such as voice.

ANI Automatic identification of the calling station

ANSI American National Standards Institute.

ATIS Alliance for Telecommunications Industry Solution (formerly ECSA). Responsible for ANSI SS7 standards and US GSM standardization.

BS Base Station

CPAS Cellular Priority Access Service

ESN Electronic Serial Number

GETS Government Emergency Telephone Service

HLR Home Location Register (database of subscriber records)

IFAST International Forum for AMPS Standards Technology

INC Industry Numbering Committee

IS TIA Interim Standard.

JEM Joint Experts Meeting

J-STD Joint ATIS and TIA standard.

LERG Local Exchange Routing Guide

LEA Law Enforcement Agency

MS Mobile Station (i.e. wireless phone)

MSC Mobile Switching Center (aka MTSO)
NAG Numbering Advisory Group
PACA Priority Access Channel Assignment
PN TIA Project Number. Identifies a project during development of a standard.
SP ANSI Standards Proposal. ANSI equivalent of a PN
TLDN Temporary Local Directory Number
TIA Telecommunications Industry Association
TTY Text Telephony
TDD Telecommunications Device for the Deaf
VLR Visited Location Register
WIN Wireless Intelligent Network

APPENDIX L
Industry Implementation Status Reports
Contained within are written industry TTY implementation status reports as submitted to the Secretariat.
Table of Contents

Network Infrastructure Software Development

TDMA Network: AT&T Wireless has inquired of all three of our TDMA (ANSI-136) infrastructure vendors concerning the status of their TIA/EIA IS-823 software development efforts. The information obtained from each is outlined below:

Ericsson: Ericsson reports that they plan to support IS-823A as a correction to Version 7 ANSI

Lucent: Lucent has currently integrated IS-823A support into Version 17.0 for test purposes

Nortel: Nortel reports that they have integrated IS-823A support as a "prep" release in MTX10

GSM Network: AT&T Wireless is evaluating two of the three options for TTY support over GSM (3GPP TS 26.226). In early May, AT&T Wireless expressed its support for the "circuit-pooling" approach through the GSMNA. AT&T Wireless is also investigating the implementation of an all-transcoder based approach, which is fully compatible with the circuit-pooling approach. The third support approach, which is based on the deployment of a centralized network server, is not currently under active consideration by AT&T Wireless.

Handset Development and Testing Plans

TDMA Handsets: AT&T Wireless has inquired of four TDMA (ANSI-136) handset vendors concerning the status of their TIA/EIA IS-823 development and testing efforts. The information obtained from each is outlined below:

Ericsson: Ericsson reports that they are planning to support IS-823A on a handset that should be available to our lab in Q4, 2001

Motorola: Motorola provided an IS-823 compatible handset for preliminary testing in our lab during Q2, 2001

Nokia: Nokia provided an IS-823 compatible handset for preliminary testing in our lab during Q2, 2001

Panasonic: Panasonic provided our test lab with an IS-823 handset during Q2, 2001

GSM Handsets AT&T Wireless has obtained information from three GSM handset vendors concerning the status of their 3GPP TS 26.226 development and testing efforts. The information obtained from each is outlined below:

Ericsson: Ericsson reports that they are planning to integrate 3GPP TS 26.226 support into a handset for lab availability in Q3, 2001.

Motorola: Motorola reports that they are planning to support 3GPP TS 26.226 on a handset that should be available to our lab in Q3, 2001

Nokia: Nokia reports that they are planning to support 3GPP TS 26.266 on a handset available in Q1, 2002

Beta and Lab Testing

AT&T Wireless has in place a full integration lab for Ericsson, Lucent, and Nortel TDMA infrastructure equipment. As of the date of this report, Lucent R17.0 software (which supports IS-823A) has been loaded into a test switch within the AT&T Wireless test lab for regression testing and preliminary TTY feature testing. TTY software from the remaining TDMA infrastructure vendors (Ericsson and Nortel) will be loaded into their associated test switches as applicable releases become available. In all cases, TTY-compatible switch software will be thoroughly tested in the AT&T Wireless lab before being released to a FOA (First Office Application) market.

Release and General Availability to Carriers of Software

TDMA Network: AT&T Wireless has inquired of all three of our TDMA (ANSI-136) infrastructure vendors concerning the release of their TIA/EIA IS-823A software for general availability. The information obtained from each is outlined below:

Ericsson: Ericsson reports that they are planning to support IS-823A as a correction to Version 7 ANSI, which should be generally available as of Q3, 2001

Lucent: Lucent reports that IS-823A will be supported in Version 17.0, which should be generally available during Q3, 2001

Nortel: Nortel reports that they are planning to support IS-823A in MTX10, which should be generally available as of Q4, 2001

GSM Network:

AT&T Wireless does not currently have suffcient information from vendors to determine general availability of GSM TTY support at this time.

Availability to Carriers of Full Acceptance Test Units

TDMA Handsets: AT&T Wireless has inquired of four TDMA (ANSI-136) handset vendors concerning the general availability (GA) of TTY-compatible handsets. The information obtained from each is outlined below:

Ericsson: Ericsson reports that they are planning to have an IS-823 handset available for GA in Q2, 2002

Motorola: Motorola reports that they are planning to have an IS-823 handset available for GA in Q1 of 2002

Nokia: Nokia reports that they are planning to have an IS-823 handset available for GA in Q1 of 2002

Panasonic: Panasonic reports that they are planning to have an IS-823 handset available for GA in Q3 of 2001

GSM Handsets: AT&T Wireless does not currently not have sufficient information from vendors to determine the general availability of GSM TTY handsets at this time.

Efforts Toward Achieving Digital Wireless Solution Compatibility with Enhanced TTY Devices

Based on the agreements reached during TTY Forum 17, this issue has been sufficiently addressed by TTY manufacturers and should not require further effort on the part of carriers.

Carrier Testing Activities, Including Field Testing and Consumer End-to-End Testing

Test Plan Documentation

AWS has developed internal documents that address the lab testing of both GSM and TDMA TTY-compatible handsets and networks. FOA test plans for TDMA platform equipment and handsets have also been prepared, and these documents continue to evolve.

In addition to the preparation of internal test documents, AT&T Wireless also wrote and contributed a preliminary TTY test plan for GSM handsets to GSM North America. This document was presented to the GSMNA PTCRB on 8 May, 2001, during their meeting in Calgary, AB.

AT&T Wireless will contribute its TDMA handset test plan to the TTY Forum if there is sufficient interest in our doing so.

TTY Testbed Development

AT&T Wireless has in place a full integration lab for Ericsson, Lucent, and Nortel TDMA infrastructure equipment. As of the date of this report, Lucent R17.0 software (which supports IS-823A) has been loaded into a test switch within the AT&T Wireless test lab for regression testing and preliminary TTY feature testing.

Special modems for quantitative measurement of TTY performance over a wireless devices have been obtained for use in the AT&T Wireless lab and for special FOA test configurations. These modems, along with their requisite host computers, comprise a testbed which supports TTY evaluation software applications such as the Lober & Walsh "score". In the future, Gallaudet University's "analyzer" utilities will be supported as well. The testbed audio interfaces are fully compatible with TIA/EIA TSB-121. Lab TTY testing can be perfomed in a "static" or simulated mobile environment on actual platforms of the type used in the AT&T Wireless network.

Initial TTY Lab Test Results

In June, AT&T Wireless performed preliminary TTY performance testing in its Redmond, WA labs, using Lucent network equipment and alpha-version TTY handsets from three manufacturers (Panasonic, Nokia and Motorola). Our initial test results show that the performance of the IS-823A TTY software was found to be very good, even in simulated RF channels with a very low signal to noise ratio. Almost all calls displayed a TCER (as calculated by the Lober & Walsh "score" utility) of well under 1% for streaming-data random character sets. The vast majority of calls displayed a TCER of 0%. This performance was obtained with calls made from the handset to the PSTN and from mobile to mobile. In general, streaming text at a constant speed (as sent by a computer) was more reliably decoded than manual typing. However, the difference in character error rates between these two entry methods was minimal.

The effects of call waiting, SMS during a TTY call, inter-system handoffs and handset menu navigation were also tested. Our preliminary findings are as follows:

1. **Call Waiting:** Loss of between 2 and 3 TTY characters, effect on downlink and uplink is the same.
2. **Received SMS During TTY Call**: TTY character loss is handset implementation dependent. We observed as few as 1 or 2 lost TTY characters up to 10 lost TTY characters during receipt of a 150-character TTY message depending upon how the user is alerted to incoming SMS.
3. **Transmitted SMS During TTY Call**: Observed a maximum of 1 lost character on uplink.
4. **Navigating Through Menus During a TTY Call:** Handset implementation dependent, can result in the loss of 2 to 5 TTY characters
5. **DTMF Digits Dialed During a TTY Call:** Handset implementation dependent, can result in the loss of 2 to 5 TTY characters
6. **Intra-system Cell Handoff:** Loss of 1 or at most 2 TTY characters on the downlink, between 2 and 4 TTY characters lost on the uplink.

In an effort to compare TTY performance with and without IS-823 support, we ran one of the same random-text files over the TDMA airlink with TTY support turned off. The TCER during this test was 18.8% in a nearly perfect RF channel (signal to noise ratio of greater than 40 dB).

Additional lab testing, including testing of TTY in a simulated mobile environment, will take place in Q3.

Retail Availability of Necessary Consumer Equipment

Because of the many variables present at this time, AT&T Wireless cannot report on the status of retail availability of consumer equipment.

Geographic Scope of Network Deployment

Because of the many variables present at this time, AT&T Wireless cannot report on the scope of network deployment.

Kentucky RSA 3, Kentucky RSA 4 Cellular General Partnership
Cumberland Cellular Partnership
d/b/a Bluegrass Cellular Inc.
TTY Report
Second Quarter 2001

Background

Bluegrass Cellular uses AMPS/TDMA (IS-136) technology.
Infrastructure vendor is Nortel
Phone manufactures include Nokia, Motorola, Ericcison.

Status

Bluegrass Cellular is waiting on solutions to be made available by the handset and infrastructure vendors. The infrastructure vendor has stated they will have a solution available to carriers by late fourth quarter to early first quarter 2002. The solution will be made available in software release MTX10.

Phone manufactures have also stated basically the same with possibility of a late fourth quarter 2001 release.

Until the equipment/software is available and dates are more precise, Bluegrass Cellular is unable to give timelines and procedures for testing, and consumer availability.

Bluegrass Cellular is actively working with both its vendors and the TTY Forum to ensure consumer availability as quickly as possible.

Caprock Cellular Limited Partnership

Progress of TTY-Digital Deployment Solutions
CC Docket No. 94-102
2nd Quarterly Report
July 2, 2001

#1   Network infrastructure software development:

Caprock Cellular utilizes Nortel Networks equipment to provide TDMA digital services in Texas RSA 4. A report from Nortel Networks states that development of software is complete, and product tests have been completed as well. Testing was limited to Panasonic prototype handset, as other equipment was not available during the test.

#2   Handset development and testing plans

Caprock Cellular must rely on handset vendors to develop the required handsets. When handsets are available testing can be performed with area PSAPs to insure compatibility.

#3   Beta testing and lab testing

Caprock Cellular must rely on Nortel Networks and handset vendors for initial conformance testing.

#4   Release and general availability to carriers of network infrastructure software

Nortel Networks has stated that the required sofware load, MTX10, will be generally available week 44 of 2001. The exact date of deployment of this software load is not known at this time.

#5   Availability to carriers to full acceptance test units

Nortel Networks plans to test and confirm the solution performance during the six-month extension allowed for this purpose.

#6   Efforts toward achieving digital wireless solution capability with enhanced TTY devices.

        The solution provided by the MTX10 software load addresses Baudot type messages only. Other capabilities may be included later, after standards are adopted.

#7   Carrier coordination of testing with PSAP

        See response to item #2 above.

#8   Carrier testing activities, including field testing, consumer end-to-end testing, and other necessary tests.

        Caprock Cellular cannot begin testing activities until the correct software load is installed in the switch and handsets are generally available.

#9   Retail availability of necessary consumer equipment

        At this time it is unknown when handsets will be available.

#10   Geographic scope of network infrastructure deployment

        According to Nortel Networks, the MTX10 software is the only requirement for implementation. The mobile switch, if currently at MTX09, nor the cellsite equipment will require hardware changes. (Caprock Cellular does not own the mobile switch, Plateau Telecommunications provides switching for Caprock's cellsites. Due to this fact Caprock cannot control implementation dates for the required software.)

                                                Respectfully submitted,

                                                Jim Whitefield
                                                C.E.O.

North Carolina RSA 3 Cellular Telephone Company
d/b/a Carolina West Wireless
TTY Report
Second Quarter 2001

Background

Carolina West Wireless uses TDMA technology
Infrastructure vendor is Nortel
Phone manufactures include Nokia, Motorola, Ericcison and NEC

Status

There is no change from the first quarter report concerning the availability of handset and infrastructure solutions from the vendors. The infrastructure vendor continues to set the release of the MTX10 software for late fourth quarter to early first quarter 2002.

Phone manufactures continue to set possible availability of equipment for late fourth quarter 2001.

Carolina West Wireless is unable to predict precise dates for testing and consumer availability until the software and equipment are made available.

Carolina West Wireless continues to actively work with its vendors and the TTY Forum to ensure TTY availability as quickly as possible.

June 11, 2001

To: TTY Forum

From: Sean Campbell, Susan Palmer and Ken Evans

TTY Forum #18Report
Cingular Wireless LLC

Overview

Cingular Wireless LLC would like to thank the manufacturers for the amount of progress that has been made since the last Forum. Cingular Wireless LLC has noted improvement in communication since the last meeting. The development of proposed solutions and the proposed dates are positive steps toward meeting the schedule for transmitting TTY 911 calls over digital wireless systems. However, concerns regarding testing, availability of hardware/software both on the infrastructure and handset sides remain. In addition, a number of technical issues have been identified that have not been resolved. These could delay implementation of a viable TTY solution. Our manufacturers have indicated delivery of handsets should be timely.   There are some concerns still surrounding the issue of activating and deactivating the software through the menu on the handset. This issue is under careful review by manufacturers and we hope it will be resolved soon. We will continue to work together with manufacturers and consumers to address these concerns.

At TTY Forum 18, the manufacturers announced that an ad hoc group is now meeting in addition to the TTY Forum. The TTSI (TTY Technical Standards Incubator) was created to give the manufacturers a forum to discuss technical issues and identify quick resolutions. In the future, carriers will be invited to these forums. This Industry Report will include TTSI issues as it directly impacts the implementation of the TTY solution.

TDMA

Cingular Wireless LLC believes that testing of the No Gain solution for our TDMA markets should commence shortly. Our manufacturers tell us that infrastructure software will be available to begin testing in the next few months.

We plan to have an implementation schedule developed by late 3Q or early 4Q 2001. Our next hurdle will be to have handsets available to begin testing the upgrades to the infrastructure. These units must be made available prior to BETA testing for us to test the infrastructure.

GSM

Cingular Wireless LLC is also ready to begin testing any infrastructure software for the CTM solution in our GSM markets. The same issues surrounding availability of handsets for infrastructure testing are applicable for the GSM. During the last GSM NA conference in

Calgary early in May, operators and manufacturers agreed upon a final architecture solution. GSM NA is a coalition of operators in North America that meet quarterly to address issues common to GSM operators.

This hybrid CTM solution for implementation into the Network Architecture is as a result of cooperative efforts by Ericsson, Nortel and Nokia. Because of the cooperation and compromise demonstrated at the last GSM NA meeting, it is possible for the operator to choose which Architecture Implementation best fits its needs to meet the timeline set by the FCC. At the same time, this new solution is being worked to meet the June 2002 rollout. In addition, it allows for full interoperability between vendors and continued roaming for consumers between operator boundaries.

Roaming is allowed for both 911 and non-emergency calls with the new solution. No pre-subscription is required. Our manufacturers tell us that we will have handsets that support the CTM solution in time do to regression and acceptance testing. The cooperation and collaboration by vendors, notably, Ericsson, Nortel and Nokia, is aiding Cingular and the industry in the attempt to provide service next June.

TTSI

The following issues have been identified by the TTSI

Echo Cancellors/Suppressors:

Testing has revealed that echo suppressors and echo cancellors can interfere with the proposed TTY solution. Depending upon the scenario, the TTY error rate can increase or the VCO/HCO quality will degrade. (These devices are found in all networks and are used to maintain voice and data quality.)

Interconnecting Cables:

There is an issue with use of certain cables on the handset at the 2.5mm jack. This can cause garbled characters. It does not happen with all handsets and/or all cables.

TTY Mode Switch

An action item was created to review the consumers' concerns regarding the creation of a new UI. Manufacturers and carriers will report back at the next TTSI forum (July) with an impact and resolution list.

CTM Circuit Pooling Agreement

Ericsson, Nokia, and Nortel presented a paper agreement where they state their intention to work together in developing the CTM Circuit Pooling solution. Manufacturers were not willing to fully commit without some agreement by the operators that this would be the solution preferred. Cingular presented an edited copy of a letter from the Chief Technical Officer of the GSM NA that stated agreement to this solution.

GSM Bearer Bit

There is a need for the users to have some control; a defined process needs to be created for the users to turn the TTY function on and off. Ericsson will include this in more detail in its white paper (TTY/01.06.20.05). This can, potentially, effect capacity issues surrounding the equipment set aside for TTY users. For example, handsets that are used for TTY users, then sold or given away to non-TTY users need to be addressed. This could, after some time, create a drain on the limited resources for TTY users. Cingular agreed to assist on creating a process with Ericsson testing and support

Cingular Wireless LLC remains committed to supporting the testing of new infrastructure and handset software and hardware. We would like to continue to test new software versions with manufacturers and consumers as they become available. It is necessary and vital to the success of incorporating TTY into the digital environment that consumers are involved in testing early on. In addition, we will work with manufacturers at the TTSI to insure resolution of all issues.

Once the infrastructure and terminal software has been adequately tested, we will work with the PSAP's, through Toni Dunne, and provide assistance with additional testing and support, as required.

Conclusion

Cingular Wireless notes that progress was made in the last quarter. However, as indicated by the TTSI section, a number of issues remain unresolved. The resolution of these issues can be completed in time for the June 2002 deadline. However, it will require a very aggressive effort on everyone's part to insure success. Any delays or unforeseen problems may put the date in jeopardy.

Corr Wireless Communications, L.L.C.

Corr Wireless Communications, L.L.C. (Corr Wireless) has no changes to report from the March, 2001 report. However, Corr Wireless remains confident that it will meet the FCC's deadline if the necessary equipment and software is available from its vendors.

Dobson Cellular Systems

July 12, 2001

Dobson Cellular Systems/ American Cellular Corporation

TTY Report

Dobson Cellular Systems (DCS) and American Cellular Corporation (ACC) have met with their switch vendors over the past couple months. One vendor has said that their next feature will provide vocoder enhancements to support TTY signaling transmission over TDMA channels. It will also support VCO/HCO and is completely passive. No interaction on the part of the user nor on any other parts of the wireless network beyond the vocoder.

DCS/ACC is waiting on the availability of the switch features. We expect to do field trials within the next three months. Since our last report, we have not had much interaction with the TTY Forum. We are still committed to have the ability to transmit 911 calls thru the use of TTY by December 01 and fully capable of this by June 02.

Sincerely,

Sean O'Hara

Special Project Coordinator

Dobson Cellular Systems

ERICSSON INC.
TTY Forum #18 Report
July 11, 2001

This report details the verbal presentation provided by Ericsson at the June 06, 2001 TTY Forum 18. The attached report identifies standards status, project status, technical design issues, test status, delivery planning information and contact information.

Ericsson continues to develop and test products that incorporate TTY technology. The process of integrating this technology requires a tremendous amount of system integration development, performance testing, and technical problem identification and resolution. Ericsson continues to work these technical problems, to clarify, document, identify actions, and implement solutions. Ericsson also continues to monitor Standards Organizations, ATIS Incubator, and the Industry to determine what involvement and communications are required. Ericsson has been working closely with other manufactures, test labs, and development teams to ensure product deliverables are met.

Risks:

At the TTY Forum 18 several manufacturers pointed out risks and concerns with respect to meeting the compliance requirements by the FCC. Ericsson has currently put a process in place, to assess and elevate any technical issue, which proves to be a valid problem, stemming from the integration of TTY technology into its products. Currently, Ericsson is working several issues through the industry, that have been identified as risks or technical concerns in the development of digital TTY compatibility. Several of these items have been in the resolution process since TTY Forum Meeting 17. These items include audio quality, and echo concerns as reported from the test labs.

The audio quality concerns are in the earliest stages of evaluation, and studies of the user equipment configuration and digital cellular transport behavior have yet to be fully characterized. Complete assessment and early resolution of this concern is needed to meet the mandate. Ericsson is monitoring the test data and changes proposed for self-echo, reported network echo, and echo suppressor errors. Currently Ericsson is actively participating in the ATIS Incubator process, and contributing technical guidance required to isolate, identify and resolve the issues raised.

Critical Work Status:
Several "critical work items" have been in a review process since TTY Forum Meeting 17. These items include the user intervention, TTY mode switch, and changes in TTY ballot standards.

The acceptance of user intervention, and the TTY switch, in the user interface, has alleviated a significant concern for the wireless industry. Ericsson continues to monitor the status of the TTY ballot standards, and provides contributions to those committees. Currently there are reported behavior anomalies in TTY signaling when the new circuits and software are placed within the digital cellular system. These anomalies have generated several ballot comments, which may result in multiple changes to the defined standards. Although it is evident that these

changes to the early code are required, it may also be necessary to make additional changes to accommodate technical issues stemming form system integration. For products that have completed the TTY development process significant schedule risk is incurred subsequent to each change of the balloted standard. Ericsson allocates resources when standards changes occur, to maintain schedule. Each change in TTY standards imposes a risk to the product schedule.

Ericsson believes it is in the best interest of the industry to focus on acquiring a complete list of changes needed before committing to an alternate release of the standard.

At TTY Forum 18, additional user intervention guidelines were also proposed with respect to the mode switch. Ericsson is reviewing these guidelines and is preparing a response to the Forum.

The 3GPP SA2 standards group proposed a new solution for TTY in GSM, CTM Circuit Pooling. Ericsson together with Nortel and Nokia were actively involved in drafting the standards proposals. A joint statement was presented showing Ericsson, Nortel and Nokia's endorsement of the new solution. Ericsson participated in developing a white paper that describes these changes within the ATIS Incubator group, which outline the required changes. In this solution the CTM mobile indicates to the network an interest for CTM support, and the network allocates network resources for the call.

Terminal Status:
Ericsson terminal products have progressed through the "prototype development stage" and are entering the final stages of "product test stage". The prototype build plan and initial software development are complete for all product technologies. Full system activation and test data is now being generated for CDMA, TDMA, and GSM products. Handset testing plans are in place, and test scenarios are being performed. The planning of and scheduling of product development has been completed.

Prototype testing of units for GSM is scheduled to be complete by week 28; TDMA test units are scheduled to begin week 30; and CDMA units were completed in week 26. The build and system interoperability test plans are in place. FOA partners for test have been identified for the products, as final plans are under way for the release of product compliant technologies by the FCC mandate.

Test activities are planned to include operation within Ericsson networks, Interoperability tests, and other test scenarios.

Prototype analog terminal products are being tested as a benchmark reference. Early tests of these products generated abnormal test results in the presence of echo suppressors. The product impact is being assessed. The test results have been submitted to the ATIS Incubator for further work activity.

GSM products completed the development test phase on week 26, and are entering the system test phase. Deliveries of the second build of the CTM accessory and GSM terminal is scheduled for week 28. GSM mobiles will be modified to include the CTM BIT per the new 3GPP SA2 requirements.

Terminal Plans:
Currently integrated TTY terminals are planned for CDMA, and TDMA models. Integrated CDMA and TDMA models will be generally available (GA) by December 31, 2001. GSM terminal products will employ a CTM adapter for GA date of December 31, 2001.

Network:
Ericsson has completed development planning of network projects within the company to integrate TTY technology within its product line of network base station products. The design activities are progressing for TDMA CDMA and GSM technologies. The activation of prototypes is underway for TDMA and GSM products. The assessment of transcoder performance, with the incorporation of TTY technology, is in process. Actual performance simulation and prediction will be documented for early field planning and customer information.

TDMA Status:
TDMA transcoder development software testing started in June, and prototype testing is currently being conducted at Montreal and Raleigh facilities. Initial tests show TDMA network products operational and generating positive test data Ericsson has implemented the approved-balloted versions of standard for each of the technologies. In addition, Ericsson has implemented the March 19th 2001 version of IS-823A, which includes many of the changes from the first quarter of this year. Particularly, the TDMA transcoder (IS823-A) solutions consists of TIA/EIA PN3-4614-RV1, 03/19/01 ballot version, and TIA/EIA PN3-4721-RV1 (IS-840), 03-19-01 ballot version with header fix.

C DMA Status:
CDMA transcoder software is currently in development.

GSM Status:
Development activities are ongoing for the Circuit in Pool solution. The GSM solution development testing started in June 2001, and expects to complete by end of July 2001

TDMA Plans:
Ericsson is in the test planning stage for TDMA network technologies. The TDMA FOA is scheduled for August 2001. The GA for TDMA network is planned for September 15, 2001. TDMA Network software ordering information may be obtained from the customer KAM interface.

CDMA Plans:
The CDMA FOA is planned for November 2001. The CDMA GA is expected to be January 2002.

GSM Plans:
The current beta test and lab testing schedule for GSM is to have CTM Circuit Pool Solution FOA on October 2001. Ordering information for GSM Network software and hardware may be requested from Magnus Wollman. Volume delivery is expected to start December 27, 2001.

PSAP Test Activities:

Ericsson has participated in drafting proposed test methodologies, and is working to solidify testing plans in conjunction with the ATIS Incubator. Initial contacts and planning have started in the incubator, and involvement of TRS, E-911 centers, and end users has been discussed.

Ericsson has proposed test cases to the industry and continues to participate in the definition of the test cases.

Carrier Testing Activities

Ericsson has completed discussions to be involved in the carrier-testing phase and plans to make product improvements and monitor validation testing as testing progresses.

Joint GSM Statement

The statement that Nortel, Nokia and Ericsson have agreed upon is attached.

"Coomon Statement
on Circuit Pooling.doc

Please feel free to contact either Matt Kaltenbach or Steve Coston if you have any question regarding the supplied information, or wish to contact internal test or product interfaces. Please contact your local customer interface for product sales and marketing information.

Farmers Cellular Telephone, Inc.
TTY Report
July 3, 2001

- Network infrastructure software/hardware development and testing

  Farmers Cellular Telephone, Inc.'s ("Farmers Cellular's") network consists of only one Nortel switch. We offer analog service as well as TDMA digital. Farmers Cellular has purchased the latest software upgrade from Nortel. Nortel Networks' development is complete, and product tests have been completed as well. Nortel tested with Panasonic prototypes. (Other handset vendors were not available during Nortel's NBSS10.1 test cycle).

- Handset development and testing plans

  Farmers Cellular handset vendor status: Ericsson is on schedule. Motorola has not given an update, and Nokia is on schedule.

- Schedule for deployment of the software/hardware in the Farmers Cellular switches

  The minimum baseline software requirement for this feature to be deployed in Farmers Cellular switches is MTX09 or higher. On the BSCs, the baseline requirement is NBSS 10.1 or higher. Software is scheduled to be available Week 44 and will be scheduled for deployment on specific Farmers Cellular switches on a market-by-market basis.

- Beta testing and lab testing

  Turbocode/ HiSpeed is a proprietary feature on Ultratec/Ameriphone TTY device and is not supported by TDMA standards. If TDMA standards are enhanced to support these devices, Nortel will support this in a future release. However, standards are designed to avoid supporting propriety methods and there is no known effort to standardize the propriety features.

- Release and general availability to carriers of network infrastructure software

  Under Nortel's recommendation, Farmers Cellular will engage the chosen TDMA TTY handset vendor during network testing to do interoperability testing with the Nortel Networks solution.

- Plans to test with the Public Safety Community (PSAP's)

  Farmers Cellular will schedule this testing with the PSAP centers during its network testing. Farmers Cellular will work with Nortel to identify PSAPs that would be willing to test an end-to-end solution.

- Carrier Testing activities

Testing will begin upon receipt of software.

- **Retail Availability**

  Farmers Cellular is dependent upon the availability of handsets from vendors.

- **Geographic scope of network infrastructure deployment**

  Farmers Cellular will test the four PSAPs in our geographic area when the software is available.

Farmers Cellular remains committed to meeting the FCC's tentative mandate to provide E911 TTY access to our network. The software to support IS-823 has been delayed, but Nortel's newly-scheduled release date should still allow compliance. Nortel will not support 50-baud TTY for their first release.

Great Lakes of Iowa inc
TTY REPORT
JULY 9, 2001

I.   **Network infrastructure software development**

Great Lakes of Iowa inc utilizes Nortel Networks switch to provide digital wireless services in certain areas throughout its market. **Great Lakes of Iowa inc** understands that Nortel Networks has completed its development of software and product tests (see letter from Nortel submitted in the April quarterly report of the TTY Forum ("Nortel Letter")).

II.   **Handset development and testing plans**

Great Lakes of Iowa inc must rely on handset vendors to develop the required handsets. When handsets are available, testing can be performed with area PSAPs to insure compatibility.

III.   **Beta testing and lab testing**

Great Lakes of Iowa inc must rely on Nortel Networks and handset vendors for initial conformance testing.

IV.   **Release and general availability to carriers of network infrastructure software**

Great Lakes of Iowa inc understands that Nortel Networks' enabling software load, MTX10, is scheduled for General Availability Week 44, 2001 (see Nortel Letter).

V.   **Availability to carriers to full acceptance test units**

Great Lakes of Iowa inc understands that Nortel Networks plans to test and confirm the solution performance.

VI.   **Efforts toward achieving digital wireless solution capability with enhanced TTY devices**

Great Lakes of Iowa inc understands that the solution provided by the MTX10 software load addresses Baudot type messages only. Other capabilities may be included later, after standards are adopted.

VII.   **Carrier coordination of testing with PSAP**

See response to item 2. above.

VIII.   **Carrier testing activities, including field testing, consumer end-to-end testing, and other necessary tests**

Great Lakes of Iowa inc will begin testing activities when the correct software load is installed in the switch and handsets are generally available.

IX.   **Retail availability of necessary consumer equipment.**

It is unknown when handsets will be available.

X.   **Geographic scope of network infrastructure deployment**

Great Lakes of Iowa inc understands that the MTX10 software is the only requirement for implementation. The company has not been informed of any required hardware changes.

Respectfully Submitted,

_____

Mike Mitchell
CEO

REPORT TO TTY/TDD FORUM 18
Lucent Technologies
12 June, 2001

Chris Fernandez - Product Management
Steve Benno - Algorithm Development
Jim Huntley - Lab Testing

TTY/TDD Standards

TTY Standards updated with latest fixes.

TR45.5/3GPP2 CDMA Standards

– IS-127-3 EVRC TTY Extension Balloted

– IS-733-2 13K TTY Extension Balloted

– SMV Contains TTY/TDD Extension.

TR45.3 TDMA Standards

– IS-823-A TTY for TDMA Balloted

– IS-840-A TTY Min Perf Spec Balloted

LAB TESTING OF TTY/TDD - <u>TDMA</u>

Lucent Technologies
Bell Labs Innovations

***Test Categories*:**
1) **Baseline Testing** - unimpaired TTY transmission performance for live & streaming uplink, downlink & mobile-to-mobile calls with Power Control (DTX/DDPC) ON & OFF.
2) **HO Testing** - unimpaired TTY transmission performance for live & streaming, uplink & downlink calls with Power Control (DTX/DDPC) ON & OFF under hand-off.
3) **Impairments Testing** - TTY transmission performance for live & streaming, uplink & downlink calls with Power Control (DTX/DDPC) ON & OFF with Noise + Fading on RF link.
4) **Interoperability Testing** - unimpaired TTY transmission performance for live & streaming, uplink & downlink calls with Power Control (DTX/DDPC) ON & OFF with TTY OFF at mobile.
5) **False Alarm Testing** - unimpaired and impaired TTY transmission performance for streaming uplink & downlink calls with Power Control (DTX/DDPC) ON.

***Test Results*: (Ultratec Compact TTY - Ameriphone Q90)**
1) Downlink CER ~ 0%; Uplink CER ~ 0-1+%; Streaming CER $\rightarrow$ 0%; Live CER $\rightarrow$ 1%; **There are still known Uplink problems with the TTY mobiles**.
2) Downlink better than Uplink (75 vs.125 ms mute times); HO CERs a little worse than expected; TTY mode errors may occur.
3) Faded CERs ~ same as Baseline Tests. Fading + Noise CER Uplink ~0-1% at C/I = 12 dB; Fading + Noise Downlink CERs vs. C/I depends on Power Control (DDPC).
4) TTY transmission is as expected on both links when TTY is OFF at the mobile, CER $\geq$ 3%.
5) No False Alarms found in > 30 hours of testing.
6) TTY terminals displayed some errors and variability in live testing.

LAB TESTING OF TTY/TDD - <u>CDMA</u>

Lucent Technologies
Bell Labs Innovations

<u>Test Categories</u>:
1) **Baseline Testing** - unimpaired TTY transmission performance for live & streaming uplink, downlink & mobile-to-mobile calls for both EVRC & 13K vocoders.
2) **HO Testing** - unimpaired TTY transmission performance for live & streaming, uplink, downlink & mobile-to-mobile calls for both EVRC & 13K vocoders under hand-off.
3) **Impairments Testing** - TTY transmission performance for live & streaming, uplink & downlink calls for both EVRC & 13K vocoders with Noise on RF link.
4) **TTY Interoperability Testing** - unimpaired TTY transmission performance for live & streaming, uplink & downlink calls for both EVRC & 13K vocoders with TTY OFF at mobile.
5) **False Alarm Testing** - unimpaired and impaired TTY transmission performance for streaming uplink & downlink calls for both EVRC & 13K vocoders.

<u>Test Results</u>: **(Ultratec Compact TTY - Ameriphone Q90)**
1) Downlink CER ~ 0%; Uplink CER ~ 0%; Streaming CER $\rightarrow$ 0%; Live CER $\rightarrow$ 0%;
2) Downlink CER ~ 0%; Uplink CER ~ 0%; Streaming CER $\rightarrow$ 0%; Live CER $\rightarrow$ 0%;
3) CERs with Noise same as for Baseline Tests up to FER ~ 30% on Uplink & ~ 20% on Downlink.
4) TTY transmission is as expected on both links when TTY is OFF at the mobile, CER is high.
5) No False Alarms found in ~ 60 hours of testing.
6) TTY terminals displayed some errors and variability in live testing.

TTY/TDD FOA - <u>TDMA</u>

Limited FOA (First Office Application) testing was done at 1900 MHz band frequencies only (TDMA) during May 2001.

<u>Tests</u>:

– Mobile to Landline Originations
– Landline to Mobile Terminations
– Mobile to Mobile Originations & Terminations
– Stationary & Drive Tests (including HOs)

<u>Results</u>:

– Uplink and downlink streaming tests <u>passed</u> for messages sent from the TTY/TDD terminal with no character errors.
– Downlink live tests <u>passed</u> for messages manually typed at the TTY/TDD terminal per the test plan with no character errors (error rate less than 1 in 1000 characters).
– Uplink errors were encountered when typing manually for the first one or two characters at the beginning of manual typing.
– HO errors were typically 2-3 characters; 1 TTY mode change.

TTY/TDD FOA - <u>CDMA</u>

FOA (First Office Application) testing planned for ……..

***<u>Tests</u>*: (EVRC and 13K)**
- Mobile to Landline Originations
- Landline to Mobile Terminations
- Mobile to Mobile Originations & Terminations
- Stationary and Drive Testing
- Voice Quality
- TTY Interoperability
- E-911

<u>Results</u>:
- Summary results of the tests will be provided to forum.

TTY/TDD Schedule & Milestones

TDMA Infrastructure:

- Limited FOA - late May, 2001
- Controlled Introduction - late June, 2001
- General Availability - August, 2001

CDMA Infrastructure:

- Ready for FOA - mid July, 2001
- General Availability - $\geq$ 30 days after FOA (customer permitting)

GSM Infrastructure:

- Delivery to AWS Labs - 31 October, 2001

TTY/TDD Mobiles:

- End-to-End VQ Lab Testing - In Progress
- Transition to Interoperabilty Lab - ~ August, 2001

Midwest Wireless Holdings L.L.C.
TTY Status Report
July 5, 2001

Midwest Wireless is a rural carrier that operates TDMA digital cellular service in its Minnesota, Iowa and Wisconsin markets. Due to the complexity of this issue, Midwest must rely on its switching vendor, Nortel Networks, to be 12/31/2001 software compliant in its MTX-10 software load, which is scheduled for general release during the fourth quarter of 2001.

Based on submissions to the TTY Forum provided by Nortel, and our primary handset providers, Nokia and Motorola, we believe Midwest Wireless will be capable of meeting the June 30, 2002 deployment deadline.

Respectfully submitted

Gary Christopherson
Director, External Relations & Regulatory
Midwest Wireless Holdings L.L.C.
507-385-2597

Motorola

Via Email

Dear Mr. Hall:

Motorola is pleased to submit a status report related to our efforts at attaining TTY compatibility with our digital phones and infrastructure. Motorola is a domestic supplier of cellular handsets in TDMA, CDMA, GSM, and iDEN technologies. We also provide infrastructure equipment in CDMA and iDEN technologies.

We are working closely with our carrier customers to provide them with the equipment necessary to meet the Federal Communications Commission's June 30, 2002 TTY deployment deadline. At this time, we are on track to enable these carriers to meet their obligations.

The attached report is provided to the TTY Forum for its report to the Commission for the second quarter of 2001. Please contact me at the number below if you have any questions.

Regards

Alfred R. Lucas
Vice President and Director
Office of Access Excellence
Motorola
Voice: 561-739-2505
TTY: 561-730-2506

MOTOROLA
TTY COMPATIBILITY DEVELOPMENT STATUS REPORT
2ND Quarter 2001

Product	Standard	Status	Milestones	Progress
CDMA Handset	IS 127-3 IS 733-2	System Test	IOT: June 2001 UI: August 2001 SA: 1Q 2002	Motorola infrastructure testing began March 2001.
GSM Handset	TS 26.226 TS 26.230 TR 26.231	Implementation	IOT: September 2001 UI: September 2001 SA: 1Q 2002	CTM implementation verified bit exact with the standard. Optimization and integration activities in progress. NOTE: proposed standard changes have an undetermined delay on delivery schedule.
iDEN Handset		System Test	On plan	CER tests are in progress
TDMA Handset	IS 823-A IS 840-A	Integration	IOT: July 2001 UI: August 2001 SA: 1Q 2002	Ballot version of IS-823-A implemented. Infrastructure tests to date have CER < 1%.
CDMA Infrastructure	IS 127-3 IS 733-2	Ready for FOA		Infrastructure software in field has digital TTY support available now. Only handsets are needed to commence testing.
iDEN Infrastructure		System Test[2]	On plan	CER tests are in progress.

Note: Motorola works with its carrier customers to provide them specific information related to their respective products.

Note: IOT is Inter Op Testing with RAM based parts for Character Error Rate testing
UI is User Interface testing with HCO / VCO support
ROM is availability of ROM based phones. These should be functionally identical to a RAM phone.
SA is Ship Acceptance of production volume quantities

Al Lucas
Office of Access Excellence
Motorola
Phone: 561-739-2505
TTY: 561-739-2506

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[2] iDEN System Release 9.6 (SR9.6) System Test is in progress.

Nextel Communications, Inc.
2001 Edmund Halley Drive, Reston, VA 20191

NEXTEL

July 5, 2001

Via Electronic Mail and Federal Express
Megan Hayes
The Alliance for Telecommunications Industry Solutions
1200 G Street, NW
Suite 500
Washington, D.C. 20005

Re: Nextel Communications, Inc. First Quarter 2001 Report to the TTY Forum

Dear Ms. Hayes:

Pursuant to the Fourth Report and Order of the Federal Communications Commission ("Commission") in CC Docket No. 94-102,[3] Nextel Communications, Inc. ("Nextel") hereby submits this report on the status of its efforts to attain TTY accessibility on Nextel's iDEN handsets and network. Working closely with its vendor, Motorola, Inc. ("Motorola"), Nextel is pleased to report that its TTY accessibility progress is moving ahead in a timely manner. Pursuant to this schedule, Nextel intends to fulfill the Commission's June 30, 2002 TTY deployment deadline.

Nextel is a provider of digital Commercial Mobile Radio Services using Motorola's iDEN technology. Nextel is one of only three such iDEN providers in the United States. Thus, Nextel has worked with Motorola in the research and development of a TTY compatibility solution for the iDEN product and network. Since the Telecommunications Industry Association ("TIA") approved the Lucent solution for providing TTY accessibility on digital networks, Motorola has invested significant time and resources in creating a solution that will provide the same accessibility on iDEN networks.[4] Specifically, Motorola has completed the requirements and design process, has implemented the TTY feature, and has begun lab testing of both the iDEN handset and iDEN network infrastructure.

With respect to handset deployment, Motorola has implemented the necessary changes in prototype handsets, and these currently are being tested in Motorola's labs. Once Motorola's testing is completed, and no significant set backs occur, Nextel can conduct "beta testing" of the handsets in its lab. Nextel's lab testing is currently scheduled for July-August 2001. Thereafter, Nextel will conduct a "beta test" of the TTY-upgraded handset and the upgraded iDEN infrastructure in a single Nextel market. This field test currently is scheduled for late Third Quarter/Early Fourth Quarter 2001.

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[3] *In the Matter of Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Calling Systems,* Fourth Report and Order, CC Docket No. 94-102, FCC 00-436, released December 14, 2000 ("Fourth R&O").

[4] *See, e.g.,* Fourth R&O at para. 3.

The iDEN infrastructure process also is on schedule for full deployment by June 2002. As with the handset, the requirements and design process is complete and testing in Motorola's labs is underway to permit the planned Third Quarter/Fourth Quarter 2001 field test noted above. Nextel plans to test its TTY-capable handsets and infrastructure with both the TTY community and Public Safety Answering Points. Assuming no significant setbacks in the field trial, Nextel and Motorola currently anticipate product delivery of the TTY infrastructure in Fourth Quarter 2001.

At that time, Nextel can initiate full deployment of the TTY upgrades throughout its nationwide network. As Nextel has previously explained, these modifications will impact the process for encoding the voice channel on iDEN's system. Because such vocoder modifications have the potential to impact voice quality for all Nextel users, these base station controller modifications will require considerable time and attention. At this time, Nextel anticipates completing deployment by the Commission's June 30, 2002 deadline.

Nextel appreciates the opportunity to provide this report to the TTY Forum as part of the forum's quarterly TTY report to the Commission. If you have any questions about this report, please do not hesitate to contact me at 703-433-8315.

Sincerely,

Robert D. Montgomery
Senior Manager – Regulatory Technology Development

Nortel Networks

June 26, 2001 **CDMA TTY/TDD Regulatory FAQ/RFI**

Enclosed is information regarding Nortel Networks' plans to comply with FCC's TTY requirements.

- Is the TTY/TDD part of the E911 phase II program?

  <u>Nortel response:</u> No, it is not. The TTY/TDD feature is a separate wireless feature than that of E911 Phase 2. "TTY/TDD" refers to a Teletypewriter /Terminal for Deaf Device, which is a specialized character based device that allows a Hearing or Speech Impaired person to communicate when this TTY device is connected to a TTY capable CDMA mobile handset to communicate in a Wireless network. TTY/TDD mobile phones do need to work with E911 services; they are independent features. The E911 Phase 2 functionality provides greater accuracy in determining the location of the mobile subscriber making a 911 emergency services call than that of the MTX08 E911 Phase 1 feature.

- What is the status of TTY/TDD network infrastructure software/hardware development and testing?

  <u>Nortel response:</u> Nortel Networks' development and product test is based on current standards: IS-127-2 (EVRC) & IS 733-1(13K Vocoder). New revisions of these standards will be published later this year as IS-127-3 (EVRC TTY) & IS-733-2 (13K TTY). Nortel Networks has completed testing using Qualcomm prototypes, which have shown positive results. Nortel Networks does not anticipate performance issues with any other vendor's handsets once they come available.

  Nortel Networks plans to support new and evolved standards in next year's software releases, but it will not be possible to include any new changes in this year's release, i.e. NBSS10.1. Operators will be able to deploy the Nortel Networks TTY solution based on the current standards IS-733-1, IS127-2 to meet the FCC deadline for implementation.

- What is Nortel Network's TTY/TDD plans to test and confirm solution performance including additional tests referenced in Sections 20-23 of the FCC 4th Rule and Order 12-14-2000?

  <u>Nortel response</u>: Regarding Section 20-23, Turbocode and HiSpeed is each a proprietary feature of TTY device vendors Ultratec and Ameriphone, respectively. Due to the code being proprietary Nortel Networks will not test or support these enhanced solutions. Standards are designed to avoid supporting proprietary methods, and Nortel Networks is not aware of any effort to standardize these proprietary features.

- What are the hardware baseline and software baseline to support CDMA TTY/TDD functionality?

  <u>Nortel response</u>:

Regulatory solution required	CDMA HW/SW baseline
TTY/TDD	MTX09 SW for the DMS-MTX NBSS10.1 SW for the BSC and/or BTS TTY capable handsets (3rd party)

June 26, 2001   CDMA TTY/TDD Regulatory FAQ/RFI

- What software baseline must the MTX be running in order to upgrade to MTX10 and/or NBSS10.1?

  Nortel response: The MTX is required to be running MTX09 in order to upgrade to NBSS10.1 or to upgrade to MTX10. The MTX operating system has received significant changes due to moving to a multi-processing architecture. It is because of these OS changes that an MTX cannot upgrade safely from MTX08 directly to MTX10.

- What is the Network infrastructure software/hardware planned general availability dates that support the deployment of this regulatory feature?

  Nortel response: In order to comply with the FCC's December 31, 2001 requirement for TTY/TDD, Nortel Networks commits to delivering the enabling software as follows:

Software load	CDMA SW general availability
MTX09	Today
NBSS10.1 with MTX09	October 5, 2001
MTX10 CDMA	December 7, 2001

- How is the software/hardware for TTY/TTD subscribers provisioned in the network?

  Nortel response: The provisioning for TTY must be done the same way as for the voice subscribers.

- What is the schedule for deployment of the software/hardware in the network?

  Nortel response: The minimum baseline software requirements for this functionality are given above. For questions related to scheduling its deployment into a carrier's network, please contact Nortel Networks Product Deployment.

- For TTY/TDD what are the plans to work with any wireless carrier to perform end-to-end customer tests, and when will this occur?

  Nortel response **(for verification or lead customers):** The verification process for NBSS 10.1 and MTX10 with the customer is expected to start in July 2001. Nortel recommends that the operator engage their chosen CDMA TTY handset vendor during the verification process or VO process to do interoperability testing with the Nortel Networks solution.

  Nortel response **(for NON verification or lead customers):** Nortel Networks will be validating the CDMA TTY feature with customers in a few markets through the Verification Office process for NBSS 10.1 subject to availability of handsets from those operators. This activity is expected to start in July 2001. Also refer to the above response, which encourages customers to schedule TTY testing in the Nortel Networks Wireless Interoperability Lab.

  All activities depend heavily on the availability of new TTY/TTD handsets.

- What are Nortel Network's plans to test their own or other vendor handsets with your switch solution?

  Nortel response: Nortel Networks provides only infrastructure for wireless networks. Nortel Networks does not provide mobile handsets. Even though the infrastructure software is scheduled in advance of the Dec 31, 2001 FCC requirement, commercial handset general availability dates have not been scheduled by handset vendors. Nortel Networks recommends that the operator engage its handset vendor(s) in order to respond to the FCC regarding handset availability.

June 26, 2001 **CDMA TTY/TDD Regulatory FAQ/RFI**

Nortel Networks understands that it is most challenging for handset and infrastructure manufacturers to design CDMA TTY/911 solutions and have solution commercially available by the FCC December 31, 2001 date. This difficult task is exacerbated with revisions to the standards. Nortel Networks believes that for CDMA solutions, the standard and any improvements should be immediately locked down in order for all vendors to design to a common standard and common code set. In order to meet the FCC deadline Nortel Networks will not be in a position to incorporate into the NBSS10.1 release any revisions to the CDMA standards.

Operators are encouraged to request their handset vendors to test their commercial CDMA TTY capable handsets in Nortel's Wireless Interoperability Lab.

Please contact Cher Bruce for scheduling TTY testing in the Nortel Networks Wireless Interoperability Lab, where testing is based on current published standards (Phone: 972-684-2299; Fax: 972-684-3881; csbruce@nortelnetworks.com)

- **Contacts:**

Product Marketing	**MTX10/NBSS10.1 SW**	**Kurt Raaflaub**	**972-685-2971**
Product Management	CDMA TTY/TDD	Maniam P	972-685-7203
Regulatory	E911Ph2&TTY/TDD	Charles Spann	972-684-1723
Product Deployment	CDMA NBSS SW	Mark Schwarzer	972-685-5851

June 26, 2001   **TDMA TTY/TDD Regulatory FAQ/RFI**

Enclosed is information regarding Nortel Networks' plans to comply with the FCC's TTY requirements.

- Is the TTY/TDD part of the E911 phase II program?

  Nortel response: No, it is not. The TTY/TDD feature is a separate wireless feature than that of E911 Phase 2. "TTY/TDD" refers to a Teletypewriter /Terminal for Deaf Device, which is a specialized character based device that allows a Hearing or Speech Impaired person to communicate when this TTY device is connected to a TTY capable TDMA mobile handset to communicate in a Wireless network. TTY/TDD mobile phones do need to work with E911 services; they are independent features. The E911 Phase 2 functionality provides greater accuracy in determining the location of the mobile subscriber making a 911 emergency services call than that of the MTX08 E911 Phase 1 feature.

- What is the status of TTY/TDD network infrastructure software/hardware development and testing?

  Nortel response: Nortel Networks' TDMA TTY/TDD functionality is compliant to IS-823 (TTY/TDD Extension to TIA/EIA 136-410 Enhanced Full Rate Speech Codec) for the EFRC Codec. The development and product testing are complete and system verification is being performed. Nortel Networks has tested this feature using only alpha/beta handsets from Panasonic and Motorola, which have both shown positive results. We anticipate receiving prototype handsets from other vendors shortly and will conduct testing with those handsets.

  Nortel Networks plans to support new and evolved standards in next year's software releases. Operators will be able to deploy the Nortel Networks TTY solution i.e. MTX10, which is based on the current IS-823A standard, to meet the FCC deadline for implementation pending the availability of the stable test handsets from at least two vendors. At this point the TTY feature in MTX10 is being termed a "prep" feature due to the unavailability of commercial grade handsets.

- What is Nortel Network's TTY/TDD plans to test and confirm solution performance including additional tests referenced in Sections 20-23 of the FCC 4th Rule and Order 12-14-2000?

  Nortel response: Regarding Section 20-23, Turbocode and HiSpeed is each a proprietary feature of TTY device vendors Ultratec and Ameriphone, respectively. If TDMA standards are enhanced to support these devices, Nortel will support this in a future release. Standards are designed to avoid supporting proprietary methods, and Nortel Networks is not aware of any effort to standardize these proprietary features.

- What are the hardware baseline and software baseline to support TDMA TTY/TDD functionality?

  Nortel response:

Regulatory solution required	TDMA HW/SW baseline
TTY/TDD	EDSPM SW for the ICP; MTX10 SW for the DMS-MTX TTY capable handsets (3rd party)

- What software baseline must the MTX be running in order to upgrade to MTX10?

  Nortel response: The MTX is required to be running MTX09 in order to upgrade to MTX10. The MTX operating system has received significant changes due to moving to a multi-processing architecture. It is because of these OS changes that an MTX cannot upgrade safely from MTX08 directly to MTX10.

- What is the Network infrastructure software/hardware planned general availability dates that support the deployment of this regulatory feature?

  Nortel response: In order to comply with the FCC's December 31, 2001 requirement for TTY/TDD, Nortel Networks commits to delivering the enabling software as follows:

Software load	TDMA SW general availability
MTX09	Today
MTX10 TDMA	November 30, 2001

- How is the software/hardware for TTY/TTD subscribers provisioned in the network?

  Nortel response: The provisioning for TTY must be done the same way as for the voice subscribers.

- What is the schedule for deployment of the software/hardware in the network?

  Nortel response: The minimum baseline software requirements for this functionality are given above. For questions related to scheduling its deployment into a carrier's network, please contact Nortel Networks Product Deployment.

- For TTY/TDD what are the plans to work with any wireless carrier to perform end-to-end customer tests, and when will this occur?

  Nortel response **(for verification or lead customers):** The verification process for MTX10 with the customer is expected to start in July 2001. Nortel recommends that the operator engage their chosen TDMA TTY handset vendor during the verification process or VO process to do interoperability testing with the Nortel Networks solution.

  Nortel response **(for NON verification or lead customers):** Nortel Networks will be validating the CDMA TTY feature with customers in a few markets through the Verification Office process for MTX10 subject to availability of handsets from those operators. This activity is expected to start in July 2001. Also refer to the above response, which encourages customers to schedule TTY testing in the Nortel Networks Wireless Interoperability Lab.

  All activities depend heavily on the availability of new TTY/TDD handsets.

- What are Nortel Network's plans to test their own or other vendor handsets with your switch solution?

  Nortel response: Nortel Networks provides only infrastructure for wireless networks. Nortel Networks does not provide mobile handsets. Even though the infrastructure software is scheduled in advance of the Dec 31, 2001 FCC requirement, commercial handset general availability dates have not been scheduled by handset vendors. Nortel Networks recommends that the operator engage its handset vendor(s) in order to respond to the FCC regarding handset availability.

June 26, 2001   TDMA TTY/TDD Regulatory FAQ/RFI

Nortel Networks understands that it is most challenging for handset and infrastructure manufacturers to design TDMA TTY/911 solutions and have solution commercially available by the FCC December 31, 2001 date. This difficult task is exacerbated with revisions to the standards. Nortel Networks believes that for TDMA solutions, the standard and any improvements should be immediately locked down in order for all vendors to design to a common standard and common code set. In order to meet the FCC deadline Nortel Networks will not be in a position to incorporate into the MTX10 release any revisions to the TDMA standards.

Operators are encouraged to request their handset vendors to test their commercial CDMA TTY capable handsets in Nortel's Wireless Interoperability Lab.

Please contact Cher Bruce for scheduling TTY testing in the Nortel Networks Wireless Interoperability Lab, where testing is based on current published standards (Phone: 972-684-2299; Fax: 972-684-3881; csbruce@nortelnetworks.com)

- **Contacts:**

Product Marketing	**MTX10 SW**	**Kurt Raaflaub**	**972-685-2971**
Product Management	TDMA TTY/TDD	Syed Zaidi	972-684-0403
Regulatory	E911Ph2&TTY/TDD	Charles Spann	972-684-1723
Product Deployment	TDMA MTX SW	Shawn Moffat	972-684-4293

Background:

The TTY/911 GSM solution uses a new modem called a Cellular Text Telephone Modem (CTM). If the CTM is used over the air interface then somewhere in the cellular network transcoding is required to one of the V.18 text telephone standards to ensure interwork with existing text telephone equipment. In the United States transcoding between the CTM and Baudot is used.   At the Dusseldorf 3GPP GTT/TTY meeting an enhanced "CTM Circuit Pooling Solution" was presented as a method of providing a common point of interworking for multi-vendor networks. A "fast track" focus on this solution resulted in agreement by all ATIS TTSI carrier and manufacturer participants at the June 2001 meeting to utilize the Circuit Pooling Solution. The Circuit Pooling Solution will necessitate some standards development; most critical of which is the assignment of an existing, but spare, codepoint, which the terminal must send to the network to indicate CTM, transcoding is required. There is also a requirement for the MSC switch to detect the new code point and allocate an A-interface circuit where CTM/TTY conversion capabilities will be present.

Standards & FCC Requirement
The base line standards for GSM are 3GPP

The FCC deadline is for carriers to acquire solution hardware and software by December 31, 2001, and to offer service by June 30, 2002.

The FCC requires carriers to file quarterly status reports regarding the carrier's implementation status to support TTY/911 calls over their digital systems. While carriers can directly file reports with the FCC, the FCC rules ("Fourth R & O") permit carriers to report through the organization ATIS. The next quarterly report is due July 16, 2001.

Nortel Network Solution Set
Hardware requirement – Upgrade to BSCe3 and TCUe3
Software – BSS release v13.1 or greater
A TTY/911 solution will be developed for the TCU2G, but will not be available until March-May 2002.

Development and Testing
Lab testing has not identified problems – in house testing with handsets has not occurred due to lack of available test handsets.

Product Time Line
BSCe3 & TCUe3 g2 week 41, GA 4Q 2001
BSS V13.1 g2 week 41, GA 4Q 2001
TCU2G March-May 2002

Issues and Concerns
- While some standards development is needed for the Circuit Pooling Solution, we hope manufacturers have sufficient common understanding of the solution that equipment will be generally available to provide TTY/911 service by June 2002.
- The ATIS Forums, and ATIS TTSI incubator sessions have facilitated a faster track of information sharing between manufacturers, and convergence on solutions. However, the large number of problems being detected in more complete testing (mostly with non-GSM systems, but some problems may apply to GSM systems) suggest that some TTY users may have problems with their equipment, or have problems with calls going across some types of network equipment
- The wireless industry will not know the full scope of the solution workability or possible user problems until there can be live air end-to-end (from TTY User to the PSAP) across different networks and network configurations. As most industry equipment is still in development it is not possible to project with certainty that stable acceptable TTY/911 solutions will be operational in all networks by June 2002
- Handset manufacturers have not given firm dates for test handsets or consumer GA, especially for handsets using the spare codepoint for the Circuit Pooling Solution
- There must be some method to connect the handset to the TTY, and it is unclear when equipment will be available. It is now apparent that some unshielded connection cords supplied for TTY/911 testing will cause message errors
- Industry solutions only support Baudette 45.5 TTY transmissions, propriety TTY transmissions, and European Baudot 50 are not supported.

RESPONSE TO GSM CUSTOMER

July 11, 2001

Dear GSM Customer

Enclosed is information regarding Nortel Networks' plans to comply with FCC TTY requirements, in response to raised questions.

- network infrastructure software/hardware development and testing
  Nortel response: Nortel Networks' development is in progress; lab simulation testing has been completed. Nortel has not been able to test with TTY/911 enabled GSM handsets/CTM modules, as none has been available.

  - network infrastructure software/hardware planned general availability date
    Nortel response: In order to comply with the FCC's December 31, 2001 requirement for TTY/TDD, Nortel will be committing to have G2 BSCe3 and TCUe3 hardware by week 41, with GA in 4Q, 2001, the TTY software patch, V13.1 will be available within the time frame as for the BSCe3 & the TCUe3.

    In addition Nortel Networks will have a TTY/911 solution for TCU2G equipment in the March to May 2002 time frame (controlled introduction ramp).

- schedule for deployment of the software/hardware in the Wireless switches

  Nortel response: Deployment times may vary depending upon the network configuration, how much deployment work is to be done by Nortel Networks and how much by the customer, and how many customers want common deployment times.

- Nortel Network plans to test and confirm solution performance including additional tests referenced in Sections 20-23 of the order during the six-month extension allowed for this purpose in the order, January 1 through June 30, 2002.

  Nortel response: Regarding Section 20-23

  Turbocode/ HiSpeed is a proprietary feature on Ultratec/Ameriphone TTY device and is not supported by GSM standards If GSM standards are enhanced to support the propriety codes, then Nortel will support this in a future release. However, Nortel Networks does not foresee support for the current propriety codes unless they become open and standardized.

  Background: At the TTY Forum #16, Ultratec identified a unique problem their equipment users may have had calling 911 using their advanced proprietary protocol. Ameriphone also uses an advanced proprietary protocol. While the FCC directive and the Mission of the TTY Forum was only to provide a solution for a Baudot message to 911, a committee from Forum #16 was formed to explore the feasibility of solutions for proprietary systems.

  At the TTY Forum #17, March 14, 2001, the committee reported that
  - Proprietary protocol manufacturers would advise their customers how to avoid problems with a digital wireless TTY/911 call,
  - Solution development should continue focus on providing solutions for Baudot TTY messages, and
  - The Committee be dissolved.

  The proposals were adopted at the TTY Forum #17.

- plans to test your own or other vendor GSM TTY Subscriber equipment with your transcoder solution.

  Nortel response: Nortel Networks will test with other vendor's equipment, which meets T1.718 and T1.719 standards. Major subscriber equipment vendors have been contacted regarding the availability of both test samples and production units.

  Nortel Networks recommends *(Customer's Name)* engage its handset vendors for a thorough response to the FCC.

  Nortel Networks understands that it is most challenging for handset manufacturers to design GSM TTY/911 solutions into handsets and CTM Modules and have commercial availability by the FCC December 31, 2001 date, especially with the codepoint feature. Nortel Networks is not surprised that, despite diligent work, firm handset availability dates were not generally available at the TTY #18 Forum. Nortel Networks believes that for GSM solutions, except for the minor standards work needed for the CTM Circuit Pooling Solution, any new standards or improvements should be locked down in order for all vendors to design to a common standard and common code set.

- plans to work with any wireless carrier to perform end to end customer tests
    Nortel response: A Field Test program is currently under definition.
- plans to test with the Public Safety Community (PSAP's)."

Nortel response: Nortel recommends *(Customer's Name)* should schedule this testing with the PSAP centers during its solution testing. Nortel Networks will work with *(Customer's Name)* to identify PSAPs that would be willing to test an end-to-end solution. Additionally, it is recommended that 711 functionality be tested with Telecommunications Relay Service Centers (TRS's); the 711 service is also mandated by the FCC.

Additional concerns:

Beyond the questions already responded to, we would like to address the problem issues raised at the TTY Forum #17 & #18, and at recent ATIS TTSI incubator meetings. While Nortel Networks lab testing to date has not identified an echo canceller problem with Nortel Networks' equipment and software there may be problems for some end-to-end (TTY user to PSAP) calls that may vary according to the type of consumer equipment used, and configuration of the wireless/wireline network used for the call. Nortel Networks is an active participant in ATIS Forum, and ATIS TTSI meetings where problem identification and sharing is on a "fast track". Nortel Networks is aware of problems identified, where the echo canceller/echo suppressor in the call loop has created a problem with TDMA TTY/911 solutions, and the problem may extend to GSM systems. Nortel Networks will continue to carefully review further results for any echo canceller problem in future testing, but we do not anticipate a problem with our solution at this time.

Nortel Networks has designed its TTY/911 solution to existing standards using the transcoders to provide TTY/911 communication. Nortel Networks was an active participant in developing the CTM Circuit Pooling Solution that will provide interworking for multi-vendor networks, and make possible TTY/911 calling for users roaming in different GSM networks, and is designing its solutions to support the CTM Circuit Pooling Solution. All Carriers and Manufacturers participating in the June 2001 ATIS TTSI meeting agreed to support the CTM Circuit Pooling Solution, and Nortel Networks is not aware of any key GSM equipment manufacturer that will not be supporting the solution.

Nortel Networks wishes to RED FLAG the availability of handsets and the compliancy with Codepoint CTM Circuit Pooling Solution. At this time Nortel Networks has been given tentative handset availability dates beyond the required timeframe of week 30, 2001. More importantly, Nortel has not been given availability dates for handsets complying with the Code Point CTM Circuit Pooling Solution. The CTM Circuit Pooling Solution will only work if handsets are enabled to invoke the Codepoint CTM Circuit Pooling Solution. Because handset manufacturers have not conveyed when CTM Circuit Pooling Solution GSM handsets will be available for testing network solutions, or for consumer GA, Nortel Networks cannot commit to when carriers can have a working TTY/911 solution for GSM systems.

In conclusion, please note that the TTY Forum #18 Draft Report is available, as well as TTSI problem summaries. These reports include information summarizing activities and identified problems shared within the industry to "fast track" TTY/911 solutions across all wireless technologies. Should you require access to these reports, please contact ATIS (Alliance for Telecommunications Industry Solutions) via Ed Hall (202) 628-6380 or Megan Hayes (202) 662 8653, or your Nortel Networks account representative.

Regards,

Nortel Networks

D&E / Omnipoint Wireless Joint Venture, LP
d/b/a PCS One
TTY Progress Report
July 9, 2001

Background

PCS One is a wireless service provider located in south central Pennsylvania. The company is a 50/50 partnership between D&E Wireless and Omnipoint (now VoiceStream).

The technical standard used is GSM. Our infrastructure manufacturer is Nortel and we currently sell handsets made by Ericsson, Motorola and Nokia.

Progress Report

Nortel has informed us that they are expecting to have the necessary software upgrade available in the first quarter of 2002.

We are waiting to hear from our handset manufacturers regarding when handsets will be available for testing and available for consumers.

When we have firm commitment dates from our manufacturers we will begin scheduling testing with any PSAPs that wish to do so.

We will work with VoiceStream to do everything in our power to meet the mandated deadlines.

Pine Belt Cellular, Inc.
3984 County Road 32
P. O. Box 279
Arlington, Alabama 36722

TTY Report – July 10, 2001

Pine Belt Cellular, Inc. is completely reliant upon its vendors to implement the TTY solutions in its handsets and network. Pine Belt does not have the ability to independently verify the release dates of the solutions that will be provided by the vendors.

1.) Network infrastructure software development:
> Lucent Technologies, our switch and infrastructure manufacturer is aware of the TTY requirements. Our understanding is that Lucent is currently working on software solutions at this time. Pine Belt is dependent upon Lucent providing these solutions.

2) Handset development and testing plans:
> Pine Belt Cellular uses handsets made by a number of manufacturers. The manufacturers most predominantly used by Pine Belt are Motorola, Nokia, and Kyrocera. Pine Belt will stay abreast of the developments by these manufacturers so when TTY solutions are made available, we will be able to provide these units to our customers as soon as possible.

3) Beta testing and lab testing:
> Pine Belt Cellular will begin testing TTY compatible equipment as soon as both our handset and infrastructure manufacturers provide solutions to us.

4) Release and general availability to carriers of network infrastructure software
> Pine Belt Cellular is awaiting updated reports of software availability from switching and infrastructure vendors.

5) Availability to carriers of full acceptance test units:
> Pine Belt Cellular is awaiting software and hardware availability from switching, infrastructure, and handset vendors.

6) Efforts toward achieving digital wireless solution compatibility with enhanced TTY devices:
> Pine Belt Cellular remains dependent upon the availability of vendor provided solutions to meet the FCC's tentatively mandated timeline (12-31-01) to provide E911 TTY access to our networks.

7) Carrier coordination of testing with PSAP:
> This testing target date is dependent upon solutions provided by network infrastructure vendors and handset vendors.

Page 2

8) Carrier testing activities, including field testing, consumer end-to-end testing, and other necessary tests:

Testing will begin immediately upon receipt of software and hardware. Pine Belt Cellular is dependent upon network infrastructure vendor solutions.

9) Retail availability of necessary consumer equipment:

Pine Belt Cellular is dependent upon the availability of handsets from vendors. No firm commitment has been received at this time from handset vendors.

10) Geographic scope of network infrastructure deployment:

Pine Belt Cellular service area: Alabama RSA3B2 & BTA415

SpectraCom, Inc.
d.b.a PYXIS Communications
TTY Report
Monday, July 09, 2001

PYXIS Communications uses CDMA technology to provide digital wireless service in all of our markets. PYXIS Communications is completely reliant upon its vendors to implement the TTY solution in its handsets and network.

Infrastructure Vendor Status
Nortel is PYXIS' infrastructure provider. We did not receive an updated response from Nortel in time to make this filing. Their response from our previous filling in April 2001 was as follows:

> **Nortel Network Solution Set**
> The Nortel Network software solution is in release MTX-10, scheduled for general availability week 44, 2001.
>
> **Development and Testing**
> Lab testing has not identified problems – in house testing has been done with one handset. Lack of availability of CDMA test handsets prevented testing of a wider range of subscriber apparatus.
>
> **Product Time Line**
> MTX-10, scheduled for general availability week 44, 2001, supporting code for the IS-127-2 & IS-733-1 standards, and at least one function of the code relating to the future IS-127-3 & IS-733-2 standards.
>
> **Issues and Concerns**
> * The changes to CDMA TTY/911 code, and the coming standard change has created much difficulty to design solutions to a "moving target".
> * The FCC's date for carriers to acquire TTY/911 equipment is December 31, 2001; a standard change is expected in April 2001. There is not sufficient time between April and December to fully evaluate all changes, and incorporate all proposed changes in software that customers will have in December
> * Some proposed changes are more important than others. Manufacturers can incorporate important changes without incorporating all.   It is not known how different equipment using different mixes of equipment will interoperate
> * Nortel Networks believes standards must be "locked down" for equipment developers to design to a common target for initial equipment deployment. Future changes in initial equipment standards should provide time developing a stable and fixed second round design target
> * Industry solutions only support Baudette 45.5 TTY transmissions, propriety TTY transmissions, and European Baudot 50 is not supported.
> * Ericsson has filed a Report Number 47 with ATIS that identifies a test failure where the Voice Recognition function is incompatible with the existing TTY

Detector. It is not clear if the recent Lucent code change will cure this problem, or if the problem applies to Nortel Network equipment and software.

Handset Vendor Status

Kyocera asked us to use the same information that we filed in our previous filing in April 2001. Their previous response is as follows:

KYOCERA Response:
Kyocera Wireless Corporation (KWC) is in the process of developing the TTY feature. KWC is planning to have completed the development in order for this feature to become available on commercial handset offerings in 1H2002 to meet the implementation deadline established by the FCC.

In order to meet the deadline KWC is planning to develop TTY feature support in an existing, approved, handset platform that can be used for testing. In that regard the feature can be tested and modified as necessary using a process external to our commercial product development schedules and processes.

At this time some preliminary development has commenced, but has been limited to producing feature support in the User Interface of our handsets. With respect to standards, we are also coordinating and tracking the development of the latest code changes being implemented in Qualcomm ASICs. Our understanding is these changes support Lucent's recommendations (changes to the IS-733-1 and IS-127-2 standards) proposed at the end of last year.

We have also been coordinating with the infrastructure manufacturers Lucent Technologies, Nortel-networks, and Motorola CIG with respect to their schedules and plans for feature completeness of their infrastructure. These tests will be coordinated with infra-development labs, Interoperability labs, or carrier network, depending upon availability and timing. From our communications with the infrastructure manufacturers, our understanding is that by 4Qtr2001 carriers should also have the ability to test this feature in their network. It is our intention to have the feature development process matured to the extent it could be tested on a network in that time frame.

In support of the testing we are planning, KWC has procured TTY devices manufactured by Ultratec and Ameriphone. Our understanding is these are the most widely utilized devices in the industry therefore it is our intention to limit end to end customer testing to these devices.

Motorola response:
No update/response has been received from Motorola.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of:)
)   CC Docket 94-102
Revision of the Commission's Rules)
To Ensure Compatibility with)
Enhanced 911 Emergency Calling Systems)
)
)
Second Reporting)

To: The Commission

QWEST WIRELESS, LLC AND TW WIRELESS, LLC's SECOND QUARTER 2001 REPORTING TO BE FILED THROUGH TTY FORUM

Pursuant to the FCC's Fourth Report and Order, dated December 14, 2000, in the CC Docket referred to above, Qwest Wireless, LLC, and TW Wireless, LLC [5]("collectively, Qwest") hereby submit their second report to the TTY Forum for compilation and timely filing with the FCC.

1. *Network Infrastructure Software Development*

Qwest uses two mobile switching center software vendors, Lucent and Nortel/Ericsson. Lucent is used certain Qwest markets in Washington, Oregon, Arizona, Colorado, and Minnesota. Nortel/Ericsson is used in the remaining Qwest markets in Washington, Oregon, Arizona, new Mexico, Colorado, Utah, Nebraska, Montana, and Idaho.

In order to meet its mandates regarding TTY compatibility, Qwest is completely dependent on Lucent and Nortel/Ericsson to timely deliver the TTY-compliant software.

Based on information received from Lucent, Lucent will make the required software availabe to Qwest by November 1, 2001. If Lucent delivers according to this anticipated schedule, Qwest will be on track in terms of installing required software and hardware in the Lucent markets.

Based on information received from Nortel/Ericsson, Nortel/Ericsson will make the required software available by January 2002. If Nortel/Ericsson delivers according to this anticipated schedule, Qwest will experience a delay in the software installation required by December 31, 2001. However, Qwest will still be able to test during the first quarter of 2002 and remain on track with respect to the June 30, 2002 deadline.

---

[5] Qwest Wireless, LLC, together with TW Wireless, LLC, a joint venture in which Qwest Wireless, LLC holds a majority equity and sole controlling ownership interest, provides broadband PCS services in a number of markets. This filing is submitted on behalf of both Qwest Wireless, LLC, and TW Wireless, LLC.

In connection with the scheduling of software deployment, Qwest is also working on the installation plans for vocoder hardware PHV3 or PHV4. Such vocoder hardware is also necessary to achieve network TTY compatibility.

2. *Handset Development and Testing Plans*
Qwest is discussing TTY-compatible handsets with its vendors. It appears that two such handsets will be available in the first quarter of 2002.

3. *Beta Testing and Lab Testing'*
No beta testing has been scheduled, as it is too early in the process.

4. *Release and General Availability to Carriers of Network Infrastructure Software*
See answer to question 1.

5. *Availability to Carriers of Full Acceptance Test Units*
Actual test units are not yet available at this time. Qwest continues to rely on the statement of its handset vendor Kyocera that the K1 model, which will feature a TTY connection, will be available by the beginning of next year.

6. *Efforts Towards Achieving Digital Wireless Solution Compatibility with enhanced TTY Devices*
Qwest plans to purchase representative samples of TTY devices to use in its testing efforts.

7. *Carrier Coordination of Testing with PSAPS*
Qwest expects this to be accomplished in connection with its E911 mandated testing. Qwest will coordinate testing with one or multiple PSAPs, pending upcoming discussions with various PSAPs.

8. *Carrier Testing Activities*
There are no testing activities scheduled as it is too early in the process.

9. *Retail Availability of Necessary Consumer Equipment*
Based on the information available to Qwest, there are no compatible handsets available at the present time. However, based on information from its handset vendors, Qwest expects that TTY-compatible handset models from two different vendors will be available in the first quarter of 2002. Qwest is also researching the purchase of handsets connectable to TTY devices via a standard earpiece jack

10. *Geographic Scope of Network Infrastructure Deployment*
Asa mentioned in the answer to question 1 above, deployment is expected to occur in the Lucent markets by December 31, 2001, and in the Nortel/Ericsson markets by January 2002.

Respectfully submitted:

/S/ Floy H. Jeffares

_____
Floy H. Jeffares, Government Affairs Manager

RTSC Communications, Inc. (RTSC)
TTY Report
Monday, July 09, 2001

1. **Network Infrastructure Software Development**: Specific technology has not been identified. RTSC is proposing to utilize its wireless facilities to provide a fixed wireless local loop application.

2. **Handset Development and Testing Plans**: No handsets are currently in use. When the system is constructed, development and testing will be done by the equipment vendors. This will be a criteria for selecting vendors.

3. **Beta Testing and Lab Testing**: We will rely on the equipment vendors selected to conduct beta and lab tests.

4. **Availability of Network Infrastructure Software**: As of this date, we have not selected a vendor, but these capabilities will be taken into consideration.

5. **Availability of Full Acceptance Test Units**: To this date, none are available.

6. **Digital Wireless Solution Compatibility with Enhanced TTY Devices**: Once vendors are selected, we shall encourage them to comply with TTY devices by the deadline.

7. **Coordination of Testing with PSAP**: Once we have a system and selected vendors, we will coordinate tests with our local PSAP.

8. **Carrier Testing Activities**: Once our infrastructure is in place, we will comply with all testing recommended or required.

9. **Retail Availability**: None available at this time

10. **Geographic Scope of Network Deployment**: Fixed wireless is being studied for population centers, no deployment is scheduled at this time**.**

Jerry Kessler
785/567-4281
145 N Main, P.O. Box 158
Lenora, KS 67645

TTY Forum #18 Carrier Status Report
July 10, 2001
Rural Cellular Corporation for itself and its affiliates (collectively "RCC")

1. Network Infrastructure Software Development

    TDMA Networks: RCC utilizes TDMA infrastructure from Lucent, Ericsson and
    Nortel.   RCC is relying on these three infrastructure vendors to complete software
    development.

    GSM Network: RCC is currently evaluating options for TTY support over GSM.

2. Handset Development and Testing Plans

    RCC is relying on its handset vendors for the development and testing of TTY
    capable handsets. Once handsets are available for testing, RCC will perform field
    tests in accordance with the Loeber and Walsh test plan submitted to the TTY Forum.

3. Beta Testing and Lab Testing

    Once TTY capable software is in place and handsets are available, RCC will begin
    field tests.

4. Release and General Availability to Carriers of Network Software

    RCC's infrastructure vendors have stated that the software releases to support TTY
    capability should be available by December 2001.

5. Availability to Carriers of Full Acceptance Test Units

    RCC is waiting for commitments from its handset vendors for the date that they will
    have full acceptance test units available.

6. Efforts Towards Achieving Digital Wireless Solution Compatibility with Enhanced
    TTY Devices

    RCC is working with its vendors and now with the TTY Forum to achieve a standard
    to support enhanced TTY devices.

7. Carrier Coordination of Testing with PSAP

    RCC will conduct TTY testing with any PSAP that requests testing.

8. Carrier Testing Activities, Including Field Testing and Consumer End-To-End
    Testing

RCC will conduct consumer end-to-end testing after acceptable handsets and infrastructure software upgrades are in place and tested.

9.   Retail Availability of Necessary Consumer Equipment

Retail availability is uncertain at this time.

10.   Geographic Scope of Network Deployment

RCC is proceeding on a path that assumes it will be able to meet a June 30, 2002 deployment deadline.

Siemens
TTY Report
July 11th, 2001

Siemens is investing a significant amount of effort in order to comply with the FCC requirement to support E911 calls made from TTY devices on wireless digital networks. The status provided below is based on the currently available TTY/CTM standards and assumes no changes to these standards.

Network Implementation

Siemens is developing a BSS based TTY solution. This is a "Transcoder Pooling" solution now referred to as "CTM circuit pooling solution". This solution may be implemented as an external network element on the A- interface or integrated within the TRAU. The Siemens solution will not impact the existing vocoders already deployed and supported by Siemens.

Siemens expects the first prototype units (including the necessary hardware and software) to be made available to wireless operators for testing at the end of 2001. This will allow sufficient time for the network integration testing required to meet the in service date of June 2002.

Handsets Implementation

Siemens Handset group plans to support TTY in 2002. Siemens will support TTY/CTM via an accessory cable and the handset will support the GSM bearer bit capability for signaling from the handset to the network.

Respectfully submitted,
Ilan Vardi
Siemens

Southern LINC

SOUTHERN COMPANY
Energy to Serve Your World ℠

Southern LINC® TTY Status Report
2nd Quarter 2001

Southern LINC hereby submits its status report for 2nd Quarter 2001 in accordance with the reporting requirement contained in the Federal Communications Commission's Fourth Report and Order in CC Docket No. 94-102. Southern LINC continues diligently to pursue compliance with the FCC's TTY requirements. It regularly reviews the status and availability of an iDEN TTY solution with its sole vendor, Motorola, to ensure its ability to meet the FCC's deadline of June 30, 2002. Based upon the information it has received from Motorola, Southern LINC is currently of the belief that it will be able to deploy TTY capability to its customers by June 30, 2002.

Development Activities: Southern LINC continues to communicate with Motorola regarding the development status of both the network infrastructure and handset components required for TTY capability on an iDEN network.

Testing and Deployment Activities: Once the necessary upgrades have been made to iDEN handsets and the required software changes have been released on its network, Southern LINC will test the iDEN TTY solution. Its plans for testing will incorporate the public safety community to ensure compliance for 911 calling purposes.

Geographic Scope of Network Infrastructure Deployment: Southern LINC is a regional carrier providing service in Georgia and Alabama and portions of Florida and Mississippi. Its deployment of an iDEN TTY solution will encompass its entire network.

As its plans for testing and deployment become more concrete, based upon network software and handset availability, Southern LINC will be pleased to share that information with the Commission in a future report.

For questions regarding this report, please contact:

Holly Henderson
Regulatory Affairs Manager
Southern LINC®
5555 Glenridge Connector, Suite 500
Atlanta, GA 30342
678.443.1670

Sprint PCS Report to the FCC
Prepared: 7/10/01

1. *Network Infrastructure Software Development*
   - Lack of availability of bug-free software has delayed our ability to begin interoperability testing. This is resulting in a significant delay in our initial rollout projections. In our previous report we stated that we expected software delivery from our vendors first and second quarter this year.
   - Two of our infrastructure vendors have provided software to our labs; however, several significant bugs have been identified, inhibiting our ability to begin lab and field testing in the planned time frames. (Specifically, we are concerned with the time it will take for network vendors to add the bug fixes in Lucent's changes to the standard).
   - The other two infrastructure vendors have committed to providing software to our labs by late summer or early fall.
   - We are looking to the FCC to hold infrastructure software manufacturers accountable if we are going to be held to the drop-dead date of 6/02.
2. *Handset development and testing plans*
   - TTY compatibility is dependent on Qualcomm's DMSS software (reference software integrated into their handset) distributed to licensees in April and May of 2001.
   - Following this release, handset manufacturers need to build a user interface (software).
   - Interoperability testing w/ infrastructure will follow - both at SPCS and in infrastructure labs.
   - We are dependent on handset vendors to provide TTY capable handsets prior to field-testing. We recently received handsets from four vendors and have just begun testing. Sprint PCS' remaining vendors are expected to deliver handsets within the calendar year.
   - Sprint PCS just received the final standards publication regarding cellular subscriber unit interface for TDD which may provide a solution to impedance issues related to the audio interface through the 2.5-mm jack. Sprint PCS will carefully review the standards publication and forward it on to its handset vendors.
   - We are looking to the FCC to hold handset manufacturers accountable if we are going to be held to the drop-dead date of 6/02.
3. *Beta testing and lab testing*
   - SPCS requires both lab- and field-testing prior to implementation.
   - Our internal lab-testing and field-testing are extremely intensive and require approximately two to three months each.
   - We are planning to test with consumers in various markets prior to nation-wide deployment.
4. *Release and general availability to carriers of network software*
   - Two of our four infrastructure vendors have provided software that supports TTY. We have requested software supporting TTY from our other infrastructure vendors as soon as it becomes available.
5. *Availability to carriers of full acceptance test units*
   - See # 2
6. *Efforts toward Achieving digital wireless solution compatibility with enhanced TTY devices.*
   - Sprint PCS is not pursuing a resolution of proprietary enhanced protocols as the FCC has temporarily relieved carriers of this responsibility. Sprint PCS will reevaluate enhanced protocols when industry standards supporting these protocols are in place.
7. *Carrier Coordination of testing with PSAP*
   - PSAP testing will be conducted at the time of Beta trials.
8. *Carrier testing activities, including field testing, consumer end-to-end testing*
   - As stated previously, SPCS requires both lab and field-testing prior to implementation.
   - The internal lab-testing and field-testing processes are intensive, requiring approximately two to three months each.
   - As a result, field testing has been delayed until early fall.
9. *Retail availability of necessary consumer equipment*
   - TTY capable handset sales are projected for first quarter, 2002.
10. *Geographic scope of network deployment*
    - SPCS plans to launch in specific markets in 2002, with nation-wide launch completed by June 2002.

TeleCorp Communications, Inc.
1010 North Glebe Road
Suite 800
Arlington, VA 22201

Contact:
John Garner
Director, Regulatory Compliance
601-209-8201

Date: July 10, 2001

Purpose: Quarterly TTY Report for all Markets

Status: All Lucent MSCs will have the software infrastructure to
            accommodate the TTY/TDD feature on ECP Release 17.0 and 5ESS
            Release 15.1 BWM01-0008.

            The TTY/TTD feature was tested as part of the Little Rock, AR
            Release FOA by the Lucent Team. The Test Plan is attached. All
            results were successful.

            The Upgrade schedule for ECP 17.0 remaining markets are as
            follows:

            Des Moines   07/13/01
            Evansville   07/27/01
            Little Rock   COMPLETED 5/4/01
            Memphis 1   07/20/01
            Memphis 2   07/13/01
            Milwaukee 1   07/20/01
            Milwaukee 2   08/10/01
            New Orleans 1   07/27/01
            New Orleans 2   08/03/01
            Puerto Rico   07/13/01

        The 5ESS BWM01-0008 will be loaded three days after the ECP is
        upgraded to release 17.0. All Markets should be ready of the
        TTY/TDD feature by 8/15/01.

Test Plan: Provided by Lucent FOA Team

1.1   FID 4526.0 - TTY/TDD Vocoder (Regulatory)
1.1.1 Feature Testing

1.1.1.1   Overview

This feature will enable users of EIA/TIA-825 standard text type terminals (also known as a TTY[6]/TTD[7] sets) to communicate over TDMA cellular phones with their legacy TTY/TDD sets. For the purposes of this new feature, a special TIA/EIA-136a phone, which is capable of passing TTY/TDD calls without character distortion, is required.

1.1.1.2   Testing Requirements

Software Requirements

There are no ECP/Cell translations associated with this feature. This feature is standard for this release. This feature requires 5E-15 - BWM01-0008, (FR-2) 5ESS software and all prior upgrades to and including BWM01-0007.

Hardware & Test Equipment Requirements

1. 2 ea. Special TDMA (IS-136A) TTY/TDD capable phones (Panasonic)
2. 2 ea. TTY/TDD Terminal 'off the shelf' text terminal units Ultra Tec 'Compact' for use with mobile end;
3. 1 ea TTY/TDD Terminal for Landline end (POTS use) - Ameriphone 'Q-90
4. No special hardware is required other than the 5E switch which has to use SM2K's and have PHV4's (vocodor in switch feature)

1.1.1.3   Test Cases

Test 01   TTY/TDD Test # 1 Mobile to Landline call
                Use the TTY /TDD Capable mobile and make a call from the mobile to a wired (landline) TTY/TDD terminal. Perform this test on 16.1 and 17.0 cells
                Part 1
                Use the Ultratec Compact TTY for the mobile end and the Ameriphone Q-90 for the landline end.

---

[6] TTY is a registered Trademark of the Teletype Corporation and Lucent Technologies).
[7] Telecommunication Device for the Deaf.

Exchange in both directions (at minimum) 6 lines, at a manual typing cadence, the following TTY character test message string (that uses all the letters and figures of Baudot code):

TEST MSG THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG' S BACK 1234567890 <CR>

The test message is derived from TIA/EIA 825.
Additionally send 6 times similar strings of the remaining Baudot characters available on the TTY/TDD terminals

Part 2
Repeat the same test by using the automatic send feature of the TTY text terminals (from the send buffer). Send at least 15 lines of the test message (approximately 1000 printable characters). Do this test in each direction. There shall no more than 1% (10) characters that are in error.

Test 0 2   TTY/TDD Test #2 Landline to Mobile Call
Use the TTY /TDD Capable mobile and make a call from a wired (landline) TTY/TDD terminal to the TTY/TDD mobile. Perform this test on 16.1 and 17.0 cells

Part 1
Use the Ultratec Compact TTY for the mobile end and the Ameriphone Q-90 for the landline end.

Exchange in both directions (at minimum) 3 lines , at a manual typing cadence,   the following TTY character test message string (that uses all the letters of the alphabet and numbers):

TEST MSG THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG' S BACK 1234567890 <CR>
The above message is derived from TIA/EIA 825.

Part 2

Repeat the same test by using the automatic send feature of the TTY text terminals (from the send buffer). Send at least 15 lines of the test message (approximately 1000 printable characters). Do this test in

each direction. There shall no more than 1% (10) characters that are in error.

There shall be no more than 1% character errors.

Test 03   <u>TTY/TDD Test #3 Mobile to Mobile Call</u>
Use the TTY /TDD Capable mobile and make a call from the mobile to another TTY/TDD mobile terminal. Perform this test on 16.1 and 17.0 cells.

Part 1
Use the Ultratec Compact TTY for both mobile ends.

Exchange in both directions (at minimum) 3 lines , at a manual typing cadence,   the following TTY character test message string (that uses all the letters of the alphabet and numbers):

TEST MSG THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG' S BACK 1234567890 <CR>
 The above message is derived from TIA/EIA 825.

Part 2

Repeat the same test by using the automatic send feature of the TTY text terminals (from the send buffer). Send at least 15 lines of the test message (approximately 1000 printable characters). Do this test in each direction. There shall no more than 1% (10) characters that are in error.

There shall be no more than 1% character errors.

Test 04   <u>TTY/TDD Test #4 Mobile to E-911 Call Center</u>
Prearrange with TTY Forum Representative[8] to make a t least three test calls from a TTY/TDD mobile to the 911 communications center. The 911 center has to have TTY/TDD capability to perform this test. Perform this test on 16.1 and 17.0 cells

Use the TTY /TDD Capable mobile and make a call from the mobile to the TTY/TDD terminal at the 911 center. Exchange in both

---

[8] TTY Forum Representative to be determined. Point of Contact to be provided by Jim Huntley (Lucent)

directions (at minimum) 3 lines at a manual typing cadence. Use the following TTY character test message string:

911 TEST MSG THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG' S BACK 1234567890 TIMES TEST MESSAGE

 The above message is derived from TIA/EIA 825.

There shall be no more than 1% character errors.

Test 5   TTY/TDD Test #5 Landline to Mobile Call
Use the TTY /TDD Capable mobile and make a call to a wired (landline) TTY/TDD Relay Center from   the TTY/TDD mobile. Access the Arkansas Relay Center by calling from the mobile 800-285-1131(TTY/TDD). The voice number to coordinate the testing with the Arkansas Relay Center is 800-285-1121. Perform this test on 16.1 and 17.0 cells. Alternately, use AT&T (800) 855-2880 (TTY) AT&T (800) 855-2881 (Voice) in lieu of the Arkansas numbers.

Part 1
Use the Ultratec Compact TTY for the mobile end and the Ameriphone Q-90 for the landline end.

Exchange in both directions (at minimum) 3 lines , at a manual typing cadence,   the following TTY character test message string (that uses all the letters of the alphabet and numbers):

TEST MSG THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG' S BACK 1234567890 <CR>
The above message is derived from TIA/EIA 825.

Part 2

Repeat the same test by using the automatic send feature of the TTY text terminals (from the send buffer). Send at least 15 lines of the test message (approximately 1000 printable characters). Do this test in each direction. There shall no more than 1% (10) characters that are in error.

There shall be no more than 1% character errors.

TMP CORP.
TTY REPORT
June 30, 2001

At the present time, TMP Corp. ("TMP") does not have an operational system; however, TMP expects to be on line by Fall of 2001. The following information is based on representations made to TMP Corp. by its vendors. TMP does not have the ability to independently verify these release dates and is reliant upon its vendors to implement the TTY solution in TMP's handsets and network.

1. Network infrastructure software development

Tecore, our switch manufacturer and AirNet our network infrastructure manufacturer are aware of TTY requirements. Software compliance is under evaluation at this time.

TMP is dependent upon a solution being made available by the infrastructure vendors.

2. Handset development and testing plans

At this point we are working with handset manufacturers to validate a solution for deployment in our network by the date tentatively set by the FCC.

The absence of a firm commitment by manufacturers of TTY compatibility for PCS handsets remains a major concern for TMP to provide appropriate handsets and comply with the 12-31-01 FCC mandated deadline.

TMP continues to work with its handset vendors to ensure TTY access to E911 for our consumers.

3. Beta testing and lab testing

TMP will begin testing TTY compatible equipment when solutions are provided by network infrastructure and handset vendors.

4. Release and general availability to carriers of network infrastructure
   software

TMP is awaiting updated reports of software availability from switching and network infrastructure vendors.

5. Availability to carriers of full acceptance test units

TMP is awaiting software and hardware availability from switching, network infrastructure, and handset vendors.

6. Efforts toward achieving digital wireless solution compatibility with enhanced TTY devices

TMP remains dependent upon the availability of vendor provided solutions to meet the FCC's mandated timeline (12-31-01) to provide E911 TTY access to our networks.

We expect the GSM functional performance to be similar to the other technologies and to meet or exceed all of the TTY Forum's Consumer Group requirements.

Much work will need to be done to implement the GSM solution in our network over the next year.

7. Carrier coordination of testing with PSAP

TMP's PSAP testing target date is 9-1-01. The target date is dependent upon solutions provided by network infrastructure vendors and handset vendors.

8. Carrier testing activities, including field testing, consumer end-to-end testing, and other necessary tests

Testing will begin immediately upon receipt of software and hardware from vendors.

9. Retail availability of necessary consumer equipments

TMP is dependent upon the availability of handsets from vendors. At this time, TMP has not received a firm commitment from its handset vendors.

10. Geographic scope of network infrastructure deployment
TMP service area – BTA 367

Tritel Communications, Inc
1010 North Glebe Road
Suite 800
Arlington VA 22201

Contact:
John Garner
Director, Regulatory Compliance
601-209-8201

Date: July 10, 2001

Purpose: Quarterly TTY Report for all Markets

Development Activities

1. network infrastructure software development;
       Ericsson has informed Tritel Communications Inc. that a patch to
       generic version 7 software will enable TTY compatibility.
2. handset development and testing plans;
       Tritel relies on its venders for development and testing of handsets.
3. beta testing and lab testing;
       Tritel relies on its venders for development and testing of handsets
       and mobile switch hardware and software.
4. release and general availability to carriers of network infrastructure
   software;
       no formal commitment to availability has been received from Ericsson
       as of this date.
5. availability to carriers of full acceptance test units;
       No firm commitments to availability have been received as of this
       date.
6. efforts toward achieving digital wireless solution compatibility with
   enhanced TTY devices;
       Tritel relies on its venders for development and testing of this
       solution.

Testing and Deployment Activities

7. carrier coordination of testing with PSAP;
       Tritel will utilize relationships developed during Phase I E911
       implementation to arrange end to end testing.

8. carrier testing activities, including field testing, consumer end-to-end testing, and other necessary tests;

> Tritel will develop complete testing procedures in conjunction with its venders.

9. retail availability of necessary consumer equipment;

> No firm commitments to availability have been received as of this date.

10. geographic scope of network infrastructure deployment;

Tritel has made no deployments as of this date.

US Cellular

TTY Forum 18 Quarterly Report

There have been no scheduling changes concerning the deployment of Baudot TTY over digital wireless facilities as reported in the TTY Forum 17 report which is attached.

The infrastructure availability and the handset availability are the critical items that will jeopardize the deployment. Our infrastructure vendors are on schedule.

US Cellular has not received any firm schedules from our handset vendors for product availability. US Cellular is actively escalating the product availability issue with our present handset vendors and is pursuing new vendors, which will allow us to meet the June 2000 roll out.

TTY Report for June 2001

Contents

2. Purpose

This document outlines the progress made by VoiceStream toward the mandates required by the FCC for wireless TTY access to emergency services and full user-to-user functionality. The document is for information purposes-.

3. Executive summary

Standardization work for a GSM TTY solution is continuing and VoiceStream is active in facilitating decisions that will enable 911 access as well as full user-to-user functionality. VoiceStream will deploy both NSS and BSS solutions, depending on which is the most cost-effective and timely solution for VoiceStream.

VoiceStream has been working with the global GSM community to get agreement on a common signaling mechanism applicable to both NSS and BSS solutions. Having obtained that agreement on using bearer capability signaling, VoiceStream is actively working with that community to insure that the standards work necessary to begin deployment of those solutions is completed in a timely manner. Even though the solutions are meant to address the needs and requirements of the North American hearing impaired community, the standards that must changed are developed in the 3rd Generation Partnership Project (3GPP) and thus global agreement must be obtained.

While the actual standardization work is progressing, VoiceStream has had regular meetings with all its vendors and has firm proposals for the NSS and both BSS based solutions. Because of our mix of equipment and vendors in our networks, VoiceStream anticipates deploying all three solutions but is committed to using the common bearer capability signaling for the options requiring it.

Based on the current information from our vendors, VoiceStream expects to have all solutions available for testing and trial deployment by December 2001, with full implementation by the June 30, 2002 date.

4. Background

Since September 1997, the Wireless TTY Forum (TTY Forum), representing wireless carriers, wireless equipment manufacturers, manufacturers of TTY devices, public safety organizations, and consumer organizations representing individuals who are deaf or hard-of-hearing has been meeting in an effort to develop solutions that will enable TTY users to make 911 calls on digital wireless networks. Technical solutions had been proposed for all major wireless standards and these solutions have been under going study in the relevant technical bodies, TR45.5 (CDMA), TR45.3 (TDMA) and T1P1/3GPP (GSM).

The GSM solution revolves around using CTM (Cellular Text Telephony Modem) as a method of transmitting Baudot over the GSM network. It is difficult to transmit Baudot code over the digital channel of GSM to the FCC-mandated 1% Total Character Error Rate (TCER), as the digital codecs have been optimized for speech. Baudot uses frequency components at 1.4 and 1.8KHz which would be attenuated by the low pass filtering in the codecs. In addition, the error

correcting protocols of GSM result in the character error rate for a Baudot Code transmission increasing dramatically in case of a decreasing channel quality.

For this reason, CTM had been designed to work with all speech coding strategies and it has been successfully tested with the relevant codecs for the US, which are the GSM FR, EFR and all modes of the AMR codec. CTM signals have components only between 400 Hz and 1000 Hz, which corresponds to the nature of human speech. A converter would handle the CTM functionality at the mobile, which would be either incorporated into the mobile or available as a clip-on/add-on unit. The three documents specifying CTM have now been approved in the US as American National Standards. These documents have also been submitted to 3GPP and have become the basis for the specifications developed by that group for all GSM systems worldwide.

5. Recent Standards Activity

At the most recent 3GPP plenary, there were 2 solutions proposed for GTT- transcoder based and server-based. Advantages and disadvantages for each solution had been debated, and the TSG SA Plenary agreed that a Workshop should try to address the issues of both solutions in order to provide an early Rel-5 solution. Gary Jones of Voicestream chaired the workshop, held in Dusseldorf, Germany. Discussions provided a proposal that the Workshop investigate the priorities needed for developing the solutions for GTT/TTY support and conclude if there are common paths for the prioritization of the work.

The workshop concluded that for those vendors supporting an NSS solution only a phased approach would be necessary. The first phase would support the mandated FCC E911 requirements requiring all Emergency Calls (911) to be sent along a dedicated network path capable of converting CTM into Baudot protocol. Phase two would then support the full user-to-user features and would require additional standardization work. A detailed elaboration of the ways to realize the implementation of these options was developed. It was acknowledged that the best outcome would be the completion of both phases in time to meet the FCC mandate.

Subsequent to the workshop, vendors and operators alike worked almost continually to develop consensus around a common signaling mechanism that would facilitate complete user-to-user services, 911 access, interoperability between NSS and BSS options and be implementable by the FCC-mandated date for 911 access of June 30, 2002.

Within the past several weeks, a proposal to use Bearer Capability Signaling from the handset to the network for both the Trau pooling as well as the server-based solutions has been agreed upon by all the major GSM vendors and US operators. This solution for a common signaling mechanism will allow a handset to signal the network at call setup that it is sending a CTM call and thus the network can direct that call to a network path that can convert the CTM signal into Baudot. A diagram of the architecture supporting this signaling mechanism is attached as Annex 1.

Because the signaling mechanism is common to both the sever as well as the Trau pool solutions, the operator can choose the equipment option that best fits its equipment implementation and still maintain interoperability across platforms. This capability uses a signaling mechanism that already exists in the specifications and is utilized today when setting up a normal voice call. Because this signaling mechanism is common across the options that require its use, it is totally transparent to the user – that is, a TTY call can be made by any CTM-capable handset regardless of the network implementation utilized by the operator.

Since the agreement was reached, vendors and operators have been working in the various 3GPP technical working groups to reach approval of the necessary changes to the 3GPP specifications. Expectations are now that the changes to the specifications will be approved and necessary modifications to the systems will be in the operator's networks by the June 30, 2002 deadline.

Operators are also working with handset vendors to assure a supply of CTM-capable handsets. However, because of lead times and equipment availability issues beyond the control of operators, use of a smart cable attached from the handset to the TTY device, which incorporates the CTM modem and bearer capability signaling may be necessary at the June 30, 2002 date.

5.1 The status of the standardization work as of May 19th 2001

The Global Text Telephony (GTT) activities in 3GPP SA2 and CN1 meetings in Puerto Rico, May 14-18, 2001 ended by accomplishing its goals, thanks to intensive co-operation between interested parties. (All documents referenced here are available on the www.3gpp.org web site.)

The current status of the GTT (TTY) standardization work is now:

Addition to main architecture TS 23.002 for GTT

Document S2-011468, agreed to go to SA for approval for Rel-5.
It is a very brief addition specifying three ways to add text telephony interworking in the network.

GTT Stage 2 - Architecture, TS 23.226,

Document S2-011540 describes how text conversation can be handled in 3GPP networks. For text telephony through the voice channel, three main architectures are described, with many different opportunities for implementation variations. All are adding CTM detection/conversion functions to the network.

-The "All transcoder solution." with CTM on every circuit on the way out to the terminals.
-The "CTM Circuit pool solution" with a mechanism for selecting a circuit on the way to the terminal that has the proper CTM detection/conversion capabilities, based on the terminal indicating CTM capabilities.
-The "CTM-SRF service node solution" with a service node in the core network and a mechanism to route through it for CTM detection/conversion.

Each method is described in a separate informative Annex, and the main characteristics are described in the main body of the document. The alternative transports of text standardized in IP Multimedia, CS Multimedia and un-standardized in Data channels are also introduced.
It was agreed to send it to SA for approval for Rel-5.

Change in TS 24.008 Mobile Radio Interface, Layer 3 for indication of CTM text telephone capability in the terminal
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Document N1-010906 describing an addition to Bearer Capability to indicate active CTM support in the terminal, with the intention that the network can use this indication to select circuits with CTM conversion support.

It was agreed to send the document to CN for approval in June as a separate CR, so that if any party finds any backwards compatibility issues, they can issue another proposal to the CN meeting.

GTT Stage 1, recently approved in SA1.

In the S1 meeting the week before this, the GTT Stage 1 description was agreed to be sent to SA for approval. Ericsson had issued comments towards the proposed changes, because some of them were not in line with the total goals of the GTT work item. These comments were not approved by SA1 and should be revisited, but it is not critical for the immediate progress of the work and initial implementations.

6. VoiceStream's Network Progress

VoiceStream has had regular meetings with all its vendors and has firm proposals for the NSS and both BSS based solutions. Because of our mix of equipment and vendors in our networks, VoiceStream anticipates deploying all three solutions but is committed to using the common bearer capability signaling for the options requiring it. For two of our vendors, all hardware is in place and for the third vendor, we are waiting on a single hardware node, which we expect to be delivered soon. Software and testing is awaiting completion of the standards work in 3GPP. Handset testing is awaiting the delivery of CTM capable phones.

Based on the current information from our vendors, VoiceStream expects to have all solutions available to begin testing in October 2001, ready for deployment in December 2001, with full implementation by the June 30, 2002 date.

PSAP testing coordination will be started after the network software has been delivered and handsets are available for testing. Consumer end-to-end testing will only be started after all other testing is complete.